January 1974

Smithsonian

Winter in Siberia (p.44);
human fog in Surgut

This old city has survived bombardments, invasions, earthquakes, and real estate developers.

This is Charleston, South Carolina as it looked in September 1973. Aside from some inevitable intrusions of modern society, this is much the way it looked to the people who lived here in September 1776.

No other Colonial city in America has managed to withstand the ravages of time so well, and to adjust so gracefully to the 20th century. Charleston today is a living museum complete with houses, churches and public buildings, some of them dating back as far as 1712.

A number of the older buildings still bear the scars of the British occupation. (During the Revolutionary War, Charleston was held by the British for over two years, from May 1780 until December 1782.)

But through that war and two more, through the years of change that have followed, Charleston has kept its historic past very much alive.

When you visit Charleston, of course, you don't have to spend all your time in the past. Or even in Charleston.

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11. Heyward Washington House (Museum) 1770c.
12. 30 South Battery Street 1840c.
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South Carolina

To get your free South Carolina Trip Kit, just write South Carolina Division of Tourism, Room 52 & Box 78, Columbia, South Carolina 29202.

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January 1974

Smithsonian

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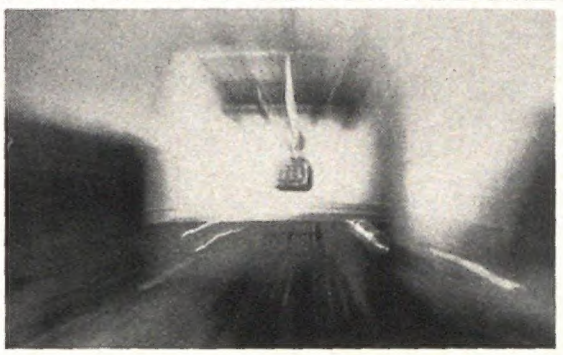

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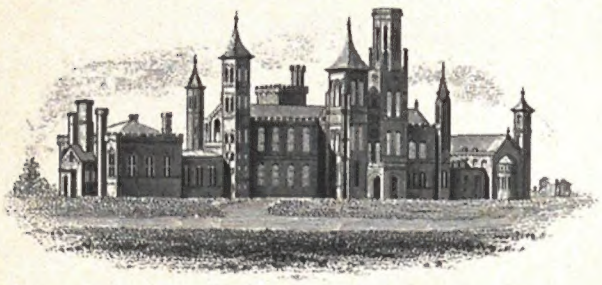
Secretary Ripley's comments

The view from the castle



While we are trying to save our physical environment we must recognize that our cultural heritage is equally imperiled

"The past is an interest without a constituency; it has no effective lobby." So writes Karl Meyer in his recent book *The Plundered Past* (reviewed in December SMITHSONIAN), adding that "the past is menaced by the very civilization that has evolved from it."

Last July, Senator Claiborne Pell of Rhode Island thoughtfully convoked two days of hearings in the U.S. Senate during which particular attention was paid to the need for improved museum conservation programs. This was only the second time that such hearings had been held on a subject of which most people are crushingly unaware.

How many people know that stone sculptures in Europe are being eroded by smog before their eyes; that the lead that holds the priceless medieval stained glass in great cathedral windows is buckling helplessly; that six percent of Venice's estimated 10,000 masterpieces in marble, five percent of its frescoes, three percent of its paintings on canvas and two percent of its paintings on wood are being lost each year? If that rate is accurate, by 1990 there will be no great marbles left in Venice except for those in museums. And Venice is not alone. Professor Seymour Z. Lewin of New York University has warned that the carved outdoor art of the world "is melting away like an ice-cream cone in the summer sun." Yet for only $1 million—Dr. Lewin's figure—we might perfect a cure for the stone disease caused by automobile exhaust and the emissions of our homes and factories.

The world travel industry annually takes in some $25 billion, not counting air fares, from people going around the world to look at—what? Tumbled heaps of decay? And yet to bring about a change would be almost painless. A small tax on art sales for the benefit of UNESCO or its affiliate, the International Council of Museums, or to help support the World Heritage Fund, would do the trick. Even a subvention of a half-million dollars from the United Nations itself might be enough to start the ball rolling. One million dollars is less than big museums and wealthy collectors have recently been willing to spend on a single object. What is the value of one splashy acquisition compared with research for posterity?

An increasing number of major sites and monuments around the world, from Venice itself to Angkor Wat to Mohenjo-Daro in Pakistan, are crumbling away before the eyes of those who do not know what is happening. The World Bank has expressed an interest in shoring up economies in the Third World by helping to develop those nations' tourism. Their decaying archaeological monuments are in many cases their only assets when it comes to attracting tourists and attempting to achieve a more favorable balance of payments.

In June 1972 I attended in Stockholm the first U.N. Conference on the Human Environment. It was chiefly concerned with the deterioration of our physical environment. Meyer hopes, in his book—as I do—that a similar international conference under the same auspices may be called to discuss the deterioration of our cultural environment. The two are part and parcel of the same thing—the one will be lost with the other.

S. Dillon Ripley

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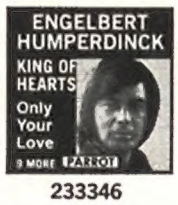

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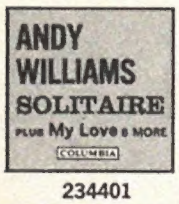

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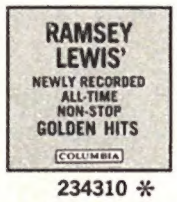

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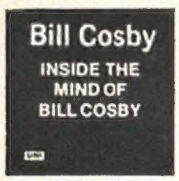

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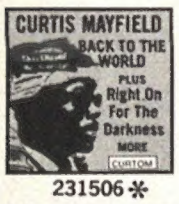

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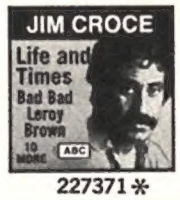

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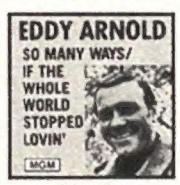

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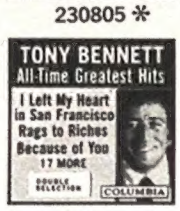

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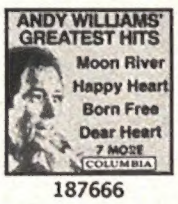

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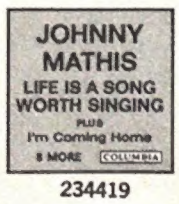

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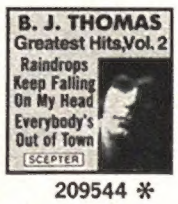

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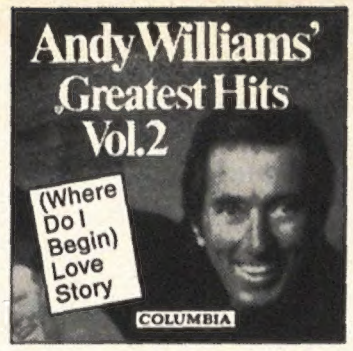

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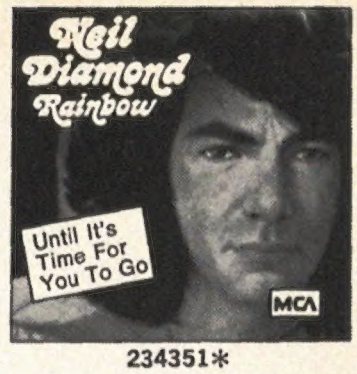

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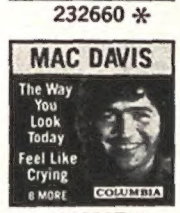

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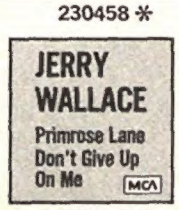

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Phenomena, comment and notes

The flea as catapult, women drivers more or less vindicated, seeing straight and the earliest ecologist

Ecology's star has risen so fast that the meaning of the word may disappear altogether. For example, we now have *the* ecology, as in: "If they build that highway, they'll ruin the ecology." Have you ever heard a legislator or social reformer say that something is bad (or good) for the sociology? Ecology is a field of study, not a field of flowers.

And it is not a nice, friendly feeling about nature, either, or a desire to save a tree from the ax. A lot of literary folk are taking turns these days turning up the First Ecologist among the poets: "Wow! John Donne (or Dante or Shakespeare or practically anyone you choose) was an ecologist! He says right here that we are all connected to nature."

But St. Francis knew that, too, and so did the Eskimos and, for all we know, so did Neanderthal man. And that doesn't mean that a single one of them was an ecologist any more than a yachtsman who knows that the wind currents drive his boat is a physicist.

Ecology is a science which seeks to determine in precise terms the exact nature of the interrelationships among living organisms and their physical surroundings. It is rigorous and full of formulas and complex energy flowcharts.

The word was coined (in the form "Oekologie") by a German biologist, Ernst Haeckel, in the 1860s to describe a study he was about to start of those very interrelationships, but he got sidetracked into phylogeny. Then who was The First Ecologist? As in the manner of the old saying about the man who returned from death and described God—first of all, she was a chemist.

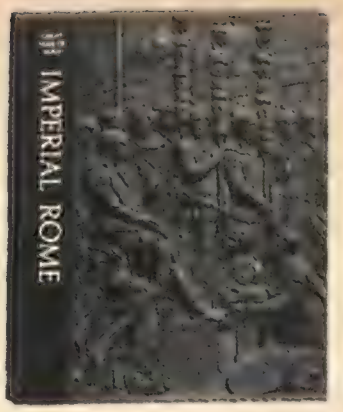
According to a new book by Robert Clarke, her name was (and his book's title is) Ellen Swallow. The first woman to enter MIT (in 1871), she was denied the opportunity of graduate study there but soon began making interdisciplinary analyses of natural and man-caused water pollution. Unfortunately, history is not tidy; by the time Ellen Swallow got around to adopting Haeckel's word for her field, she too had begun to veer away from what we now think of as ecology—to an all-inclusive home economics.

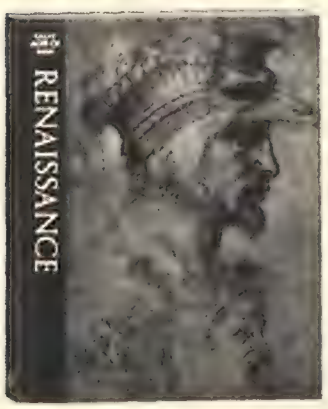
Eventually ecology may become a much-needed global home economics (the Greek root means household), but that is a long way off.

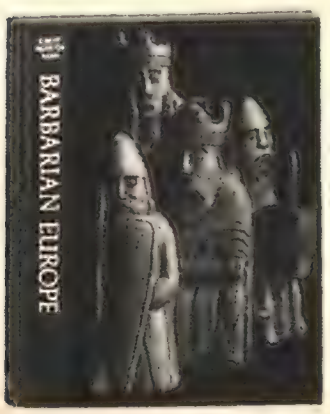
Ellen Swallow samples water pollution.

An angle on seeing

Evidence has been accumulating recently that you see what you learn to see. Newborn cats, deprived of the sight of horizontal lines, don't see them very well when they grow up. Now two psychologists from Queen's University in Kingston, Ontario, have tested the visual acuity of people of European descent and that of Cree Indians. They report in *Science* that the Euro-Canadians don't see oblique features as well as horizontal or vertical ones, whereas the Crees have no such trouble.







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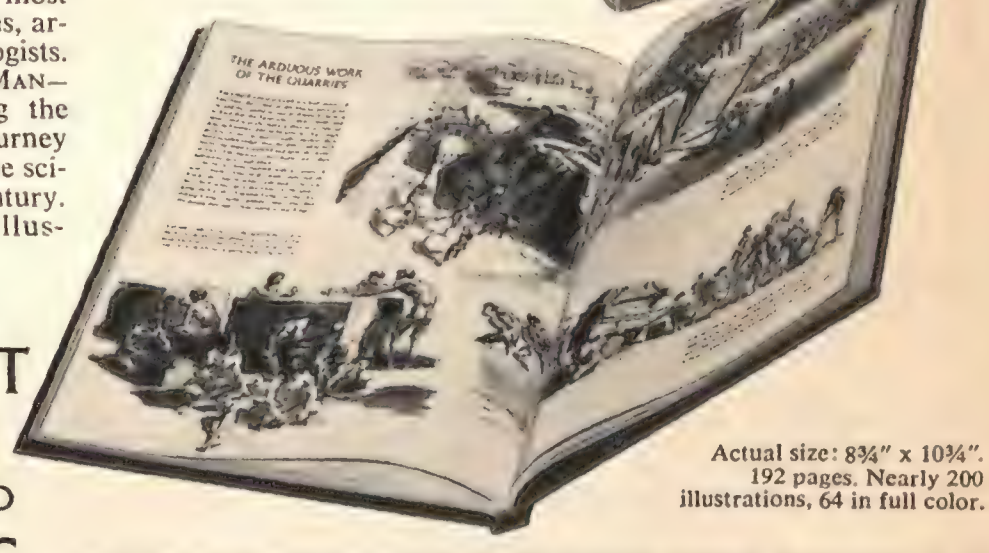

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The blame, the psychologists say, seems to lie in what they call the "carpentered" environment of the Euro-Canadians (meaning square houses and straight streets). Cree children, on the other hand, grow up in homes blessed with a variety of contours.

So it is up to the architects whether or not we grow up squares.

The trouble with geologists

A while ago the American Geological Institute made a confidential survey of nonacademic employers about recently trained geologists, presumably with an eye to recommending changes in the geological curriculum. Judging from the responses, the new crop of geologists seem a pretty sorry lot.

As reported in *Geotimes,* the employers want more engineering-type courses, more field experience and more initiative. A frequently registered complaint is that new geologists write poorly.

To make room for the more practical courses, one employer suggested that geologists forget about taking foreign languages, which have "not proved helpful in ... developing oil and gas fields."

She who hesitates is saved

About six percent of traffic accidents take place during the maneuver which we call passing, but which the British call overtaking (which, of course, they do on the right). That may not seem like much, but passing accidents are frequently among the most serious—for what would seem obvious reasons. Elaborate tests have recently been run in Europe by an international association interested in driver behavior, and the tentative results are just about what you would expect. Passing is harder than it seems, thanks to the driver's difficulty in estimating both his own speed and that of an oncoming vehicle.

A few unexpected insights emerged, however, and were reported in *New Scientist.* About 30 percent of British drivers are unsafe when overtaking and the same with Swedish drivers, but West Germans declared themselves 97 percent safe.

The worst sin in passing accidents is not conflict with oncoming vehicles but a sudden change of direction on the part of the car being passed.

Big, high-performance cars and sports cars are the worst offenders in passing accidents—a blow, says *New Scientist,* to the theory of a "skilled elite."

Sex differences were analyzed. Indeed, women get into "significantly less" passing accidents and this, *New Scientist* says a bit ungraciously, confirms "the conventional view of the woman driver as a hesitant ditherer."

How the flea jumps

Admiration for the oriental rat flea, a major vector of bubonic plague, is hardly widespread but there are things about it that have attracted the attention of one of the most extraordinary ladies of British science, Miriam Rothschild. She and four colleagues have reported on its athletic prowess in *Scientific American.*

The oriental rat flea can jump 3.6 inches in the air which is nearly 100 times its own length. Furthermore, if unfed, it can jump 600 times an hour for as long as 72 hours. And it lands on its feet 78 percent of the time, unlike uncontrolled (and comparatively unspectacular) hops of the grasshopper, which often somersaults and lands on its back.

What interests Miss Rothschild, however, is not athletic records but technique which, simply stated, is this:

Where the two many-segmented, long hind legs of the flea join the body, there is a kind of ligament made of resilin, a

A flea cocked, uncocked and airborne.

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protein also found in the wing-hinge ligaments of certain flying insects.

This protein is like rubber, only better. As the flea crouches, the resilin is compressed and a couple of catches made of cuticle and strategically located on the legs hook into sockets: The flea is literally cocked. Then a particular muscle relaxes, the catches open, the resilin expands, and the spring-loaded flea shoots itself into the air (see drawings).

As do the best entomologists, Miss Rothschild tries to put us briefly in the place of her insect: "One can obtain a fair idea of the remarkable arrangement . . . if one imagines a man with a perfectly elastic rubber ball incorporated in his hip joint bouncing himself upward from a kneeling position."

Try it and see how many times you land on your feet.

Don't touch the masterpieces, please

Holography is the process of photographing objects using the light of two laser beams, one of which is aimed so that it reflects from the object in question. The immediate result is photographic film that looks to most of us like an unintelligible mess. But shine laser light through the film and, as if by magic, you get a three-dimensional version of the object. (Of course, the three-dimensional quality of holographic pictures cannot be reproduced on two-dimensional paper.) In the years since its development, holography has seemed to be a classic case of a solution in search of a problem, but MIT's *Technology Review* reports that perhaps the proper problem has been found.

Called in to try and solve the problem of Venice's disintegrating treasures of sculpture (a process hastened by modern pollution), Dr. Ralph Weurker of the TRW Systems Group found he could make full-size "replicas" of the statues by holography. Thus, one can almost envision the day when holographic images of all of the world's great masterpieces of sculpture will float in space in every museum while the originals are salted away in some pollution-free vault.

"In the present state of the art," says Dr. Weurker, "a three-dimensional full-size hologram of a sculpture is so true to life that visitors will not realize it is not an original unless they attempt to touch it." Which they shouldn't do anyway.

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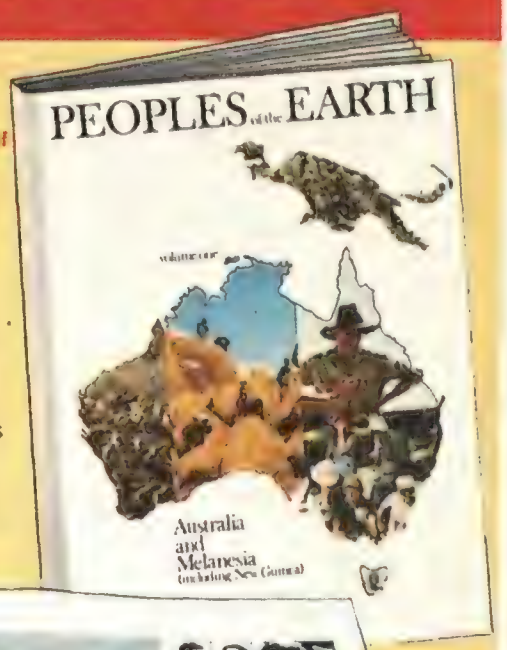

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Letters to the Editor

Autopsy of a mummy

Dear Sir: This dedicated reader of your publication found the November article, "Autopsy team seeks a mummy's medical secrets," initially fascinating. Later, I had another reaction. The idea of a team of modern medical scientists, armed with demolition, measurement and analytic equipment, gleefully disturbing the peaceful repose of some 27 centuries' duration took on haunting and repelling overtones for me.

Whatever may be learned (and may the benefits be many) from x-raying, hammering and chiseling, sawing out "panels" and "windows," measuring and describing genitalia, we are surely doing little for human dignity here. It may be counted a somewhat redeeming circumstance that poor PUM II's true identity remains unrevealed.

James N. Lesparre
Midlothian, Illinois

George Washington

Dear Sir: Wayne Barrett's delightful article on George Washington as a young lover omitted mention of one of my favorite historical characters, Eliza Bowen Jumel, who figured, somehow, in Washington's life.

She was born and brought up around Providence, Rhode Island, and made her way in the only lucrative profession then open to women—namely, the world's oldest. When she was a young woman, she had a son whom she named George Washington Bowen. Some said that he bore a remarkable likeness to the Father of his Country.

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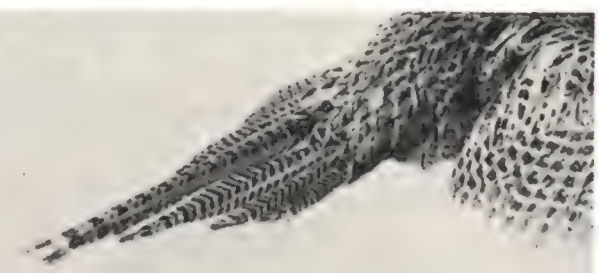

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Later in life she married a rich merchant, Stephen Jumel, and lived in the elegant house in New York City (see below), called the Morris-Jumel Mansion, which had once served as Washington's headquarters.

Although Madame Jumel was never accepted by the ladies of New York society during her lifetime, among her housekeepers today are members of the DAR, who help to maintain the house as a handsome showplace.
Helen Lillie Marwick
Washington, D.C.

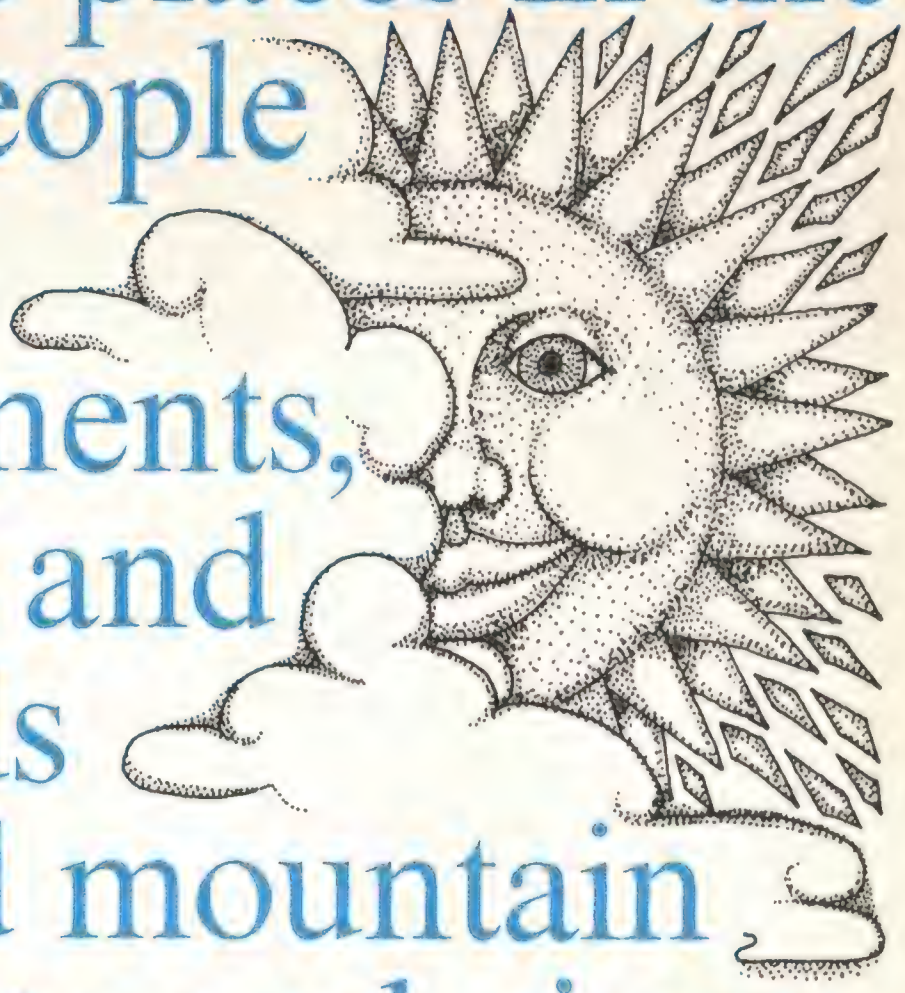
The restored Morris-Jumel Mansion

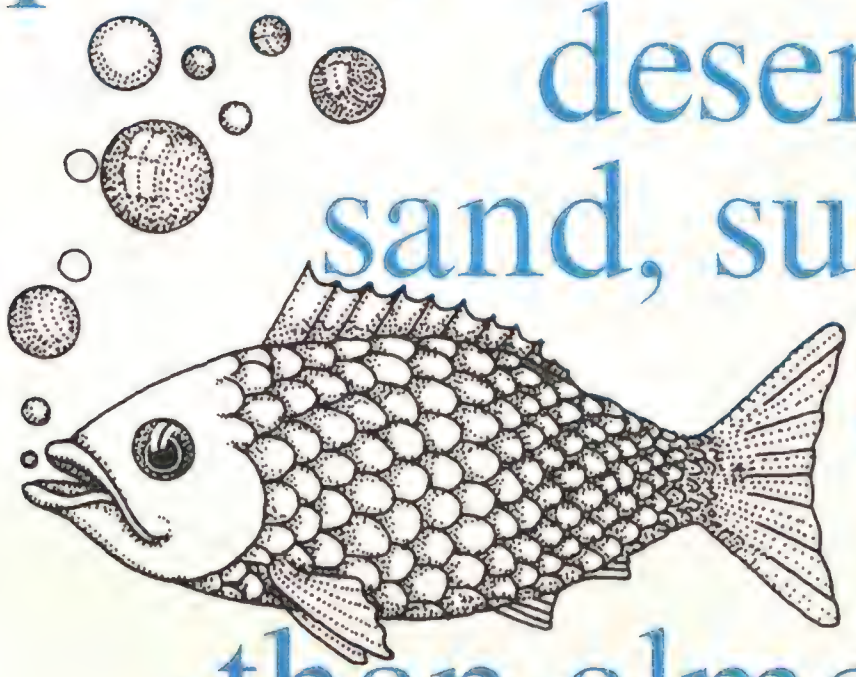
Eliza Bowen did name her son George Washington Bowen, but historians discount, as apocryphal, stories that George Washington fathered the child. There is no evidence that Washington had any children; it is believed that scarlet fever may have left him sterile. In 1833, the widow Jumel married Aaron Burr but divorced him in 1836. At least one historian reported that Eliza Bowen boasted she was the only woman who had slept with both George Washington and Napoleon Bonaparte. Ed.

Windmills

Dear Sir: Aside from the sheer esthetic beauty of a wind wheel extending above the horizon, I've long thought that wind-generated electricity is the only sensible escape from the monthly shackles of the

Of all the places in the world for people to travel... across continents, over oceans and seas, to lands of snow and mountain peaks, forests and rivers, deserts and lakes, sand, surf and sun... more people visit Florida than almost anywhere else on earth. There must be a reason.





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electric bill—not to mention the inconvenience of a power shortage.
Larry A. Miller
McCloud, California

Dear Sir: The storing of wind energy might be best accomplished, instead of using water, by having the windmills lift huge cast-iron weights to the tops of strongly built towers. The wind machine would be at the top and through proper gearing would inch the weights upward. Once at the top the weights would be released, under controlled conditions, and on moving downward would turn alternators to give alternating current.

Obviously, the wind machine could also be installed at the top of a deep shaft and the weights lifted from the bottom. This would do away with the necessity of constructing massive towers.
George Baglietto
San Francisco, California
It has generally been found that it is more economical to use water (rather than heavy metal) as the weight in the production of energy; water involves less machinery, less weight and therefore less cost. However, all types of wind machines are under consideration today. Ed.

Limnology

Dear Sir: In your article in the October issue, "Little red worms and ancient lakes in the Balkans," the title of "Dr." was erroneously attached to my name. To prevent embarrassment, I call this to your attention for correction.
Ratko J. Ristic
Center for Great Lakes Studies
The University of Wisconsin
Milwaukee, Wisconsin

State abbreviations

Dear Sir: H. Allen Smith's November article, "Neither Sn nor Ra nor Ht nor Gl of Nt," hit the nail on the head, except that he didn't go far enough. The age of technology, based on the computer, not only affects postal state abbreviations but reaches into every facet of life.

I live in California, not CA, and my name is Melvin K. Laybourne—not the M K Laybourne computers label me. That alone can get me into trouble, because there are three M.K.s in my family.
Melvin K. Laybourne
Sonoma, California

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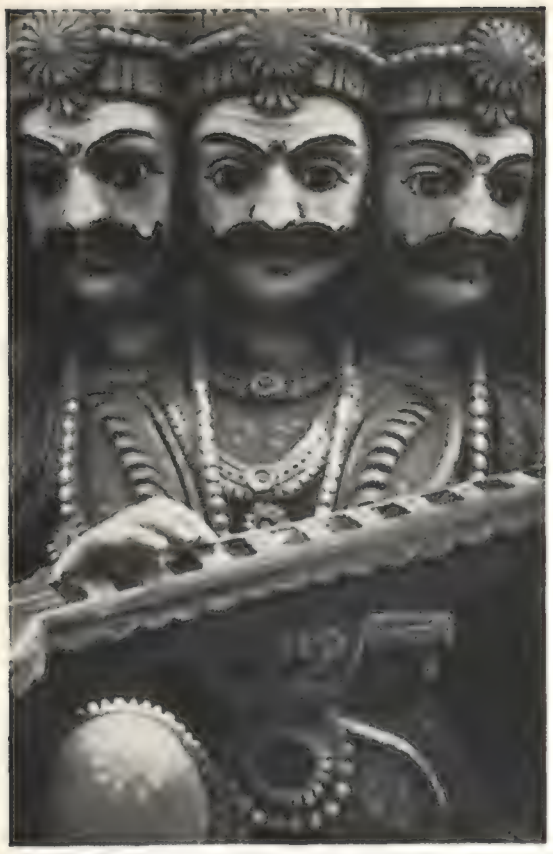

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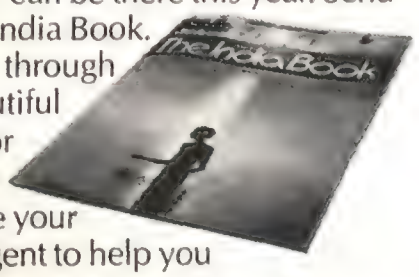

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200 years ago this month

B. Franklin tries to play politics—and loses

JANUARY 1774

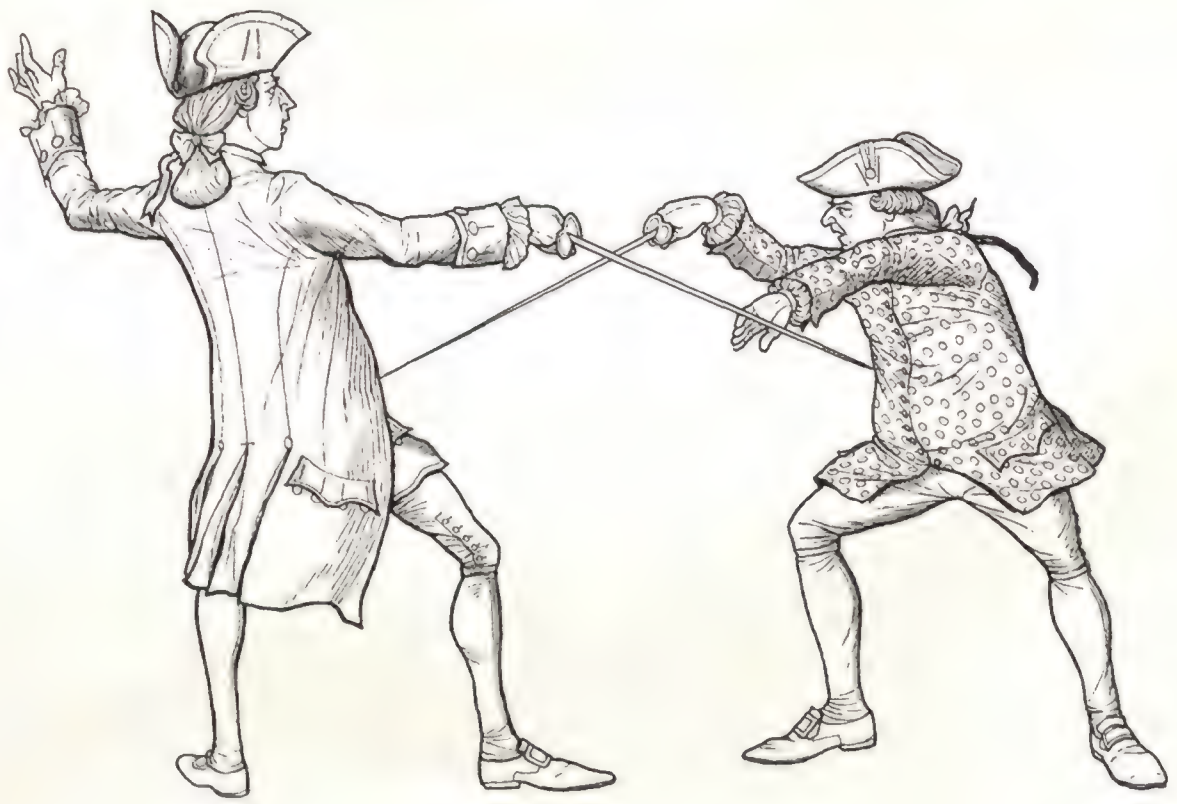
At the turn of this year, new knowledge and philosophy have shown perceptible growth. This is a time of intellect, and Man's accomplishments are burgeoning.

In Paris and Versailles, aristocrats nod and exclaim over the writings of Voltaire and Rousseau. They do not act on the thoughts of these philosophers, but they render them fashionable. In England, in the quiet Midland counties, inventions by Arkwright, Hargreaves, Cartwright, Crompton are building a new aristocracy, based on wealth gained from thinking and doing rather than inheriting.

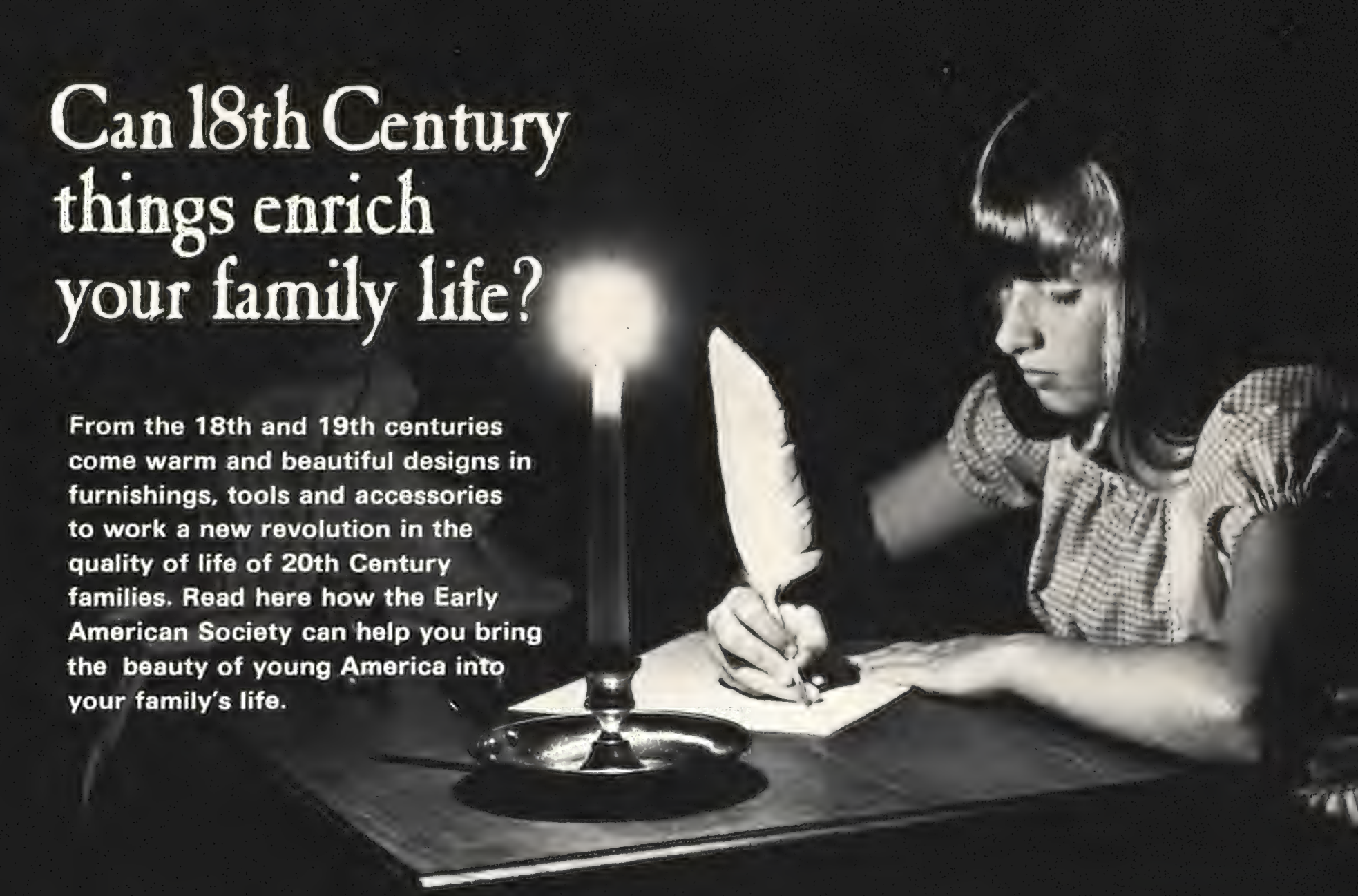
Josiah Wedgwood, the potter, is a friend of Joseph Priestley, the scientist, and of Erasmus Darwin, the doctor. They and others meet occasionally to discuss the new sort of world, open to invention of ideas as well as machines, that they feel is emerging. They think it may emerge first across the Atlantic Ocean.

One of the American Colonists these new leaders of English thought look to is Dr. Benjamin Franklin sitting in London as Postmaster-general for America. Portly, slightly bejowled, always amusing, he is revered by young scholars, honored by old societies and adored by ladies of all ages. He has had the confidence of great men and the ear of the King. Right now he is in trouble.

For years he has dreamed of a vast empire of self-governing nations extending from Britain to the Pacific, including the American Colonies and all the wild lands west of them. But as feeling in London



Can 18th Century things enrich your family life?



From the 18th and 19th centuries come warm and beautiful designs in furnishings, tools and accessories to work a new revolution in the quality of life of 20th Century families. Read here how the Early American Society can help you bring the beauty of young America into your family's life.

The Early American Society Story

Millions of present-day Americans are stimulated by the warmth and beauty of young America. Some wish to re-create in their homes a total atmosphere that recalls Colonial days. Others practice the skills that created the objects and art of the period. Still others wish to absorb the background - the "social history" of the people of that day through understanding how they lived, loved, and worked.

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To foster reading of books on these subjects, the Early American Society Book Program offers the latest books of leading publishers at discounts up to 25%. Heirloom quality reproductions of outstanding early furniture items are commissioned by the Society and made available only to members in limited editions. Group travel and historical assemblies offer members the opportunity to enrich themselves under the guidance of qualified professionals.

If your special early American interest includes antiques, restoration, arts, crafts, social history, or simply the warm style of the period, 1700-1850, your membership in the Early American Society may become one of your most valuable possessions. We are certain enough of this to offer a no-risk membership. Just mail the application below or the accompanying card. You pay only after your mind is made up that you are satisfied with your membership. Annual dues are $6.00.

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has hardened against the Americans, Franklin has been finding his mail opened, his own letters copied. To protect himself, he managed with little difficulty to play the same game—collecting some of the correspondence of his own enemies, notably of Governor Thomas Hutchinson of Massachusetts.

Hutchinson, who hates most of his fellow Americans—and Franklin especially—wrote to friends in England castigating the Colonists and recommending the use of force to crush their rebellious spirit. His was an overreaction. Most British moderates feel that the quarrel with the Colonists is largely political—Tory versus Whig—and should be settled politically.

Dr. Franklin, frustrated and angered by the gradual loss of his prestige in London, sent Hutchinson's purloined letters to Boston with instructions that they not be published. Doubtless he knew that they would be—such controversial items could not be kept secret.

Sure enough, the letters appeared in print, and last June the assembly fired off a petition to the Crown to dismiss Hutchinson. This, of course, stirred up a tumult in England. The original recipients of the Hutchinson letters began to suspect each other of causing all the trouble, and finally one dull wit accused another of stealing his mail.

The result was a duel—two angry innocents slashing at each other inexpertly, panting and grunting until one managed to pink the other. Such wretched stupidity was too much for Franklin. Caught out in his little plot, he simply admitted that he was the culprit—and asked that no more blood be spilled over it. And now, in January, he is haled before the Privy Council which has met to hear another American petition.

The original purpose of the meeting is forgotten as Britain's most powerful political leaders turn on the old scholar, baiting him with gross insults, snickering at his helplessness. The punishment is aimed at all America, for word has reached London of the Boston Tea Party.

Finally, pale and silent, Franklin bows his way out. His dreams for Britain are ended. So is his own career in England—five days after his 68th birthday.

Not far away a much younger man celebrates his 37th birthday—and also wonders about leaving his native Britain. His name is Thomas Paine.

EDWARDS PARK

Next month: Washington's dropout

Why Do You Have A Poor Memory?

A noted publisher in Chicago reports there is a simple technique for acquiring a powerful memory which can pay you real dividends in both business and social advancement and works like magic to give you added poise, necessary self-confidence and greater popularity.

According to this publisher, many people do not realize how much they could influence others simply by remembering accurately everything they see, hear, or read. Whether in business, at social functions or even in casual conversations with new acquaintances, there are ways in which you can dominate each situation by your ability to remember.

To acquaint the readers of this publication with the easy-to-follow rules for developing skill in remembering anything you choose to remember, the publishers have printed full details of their selftraining method in a new booklet, "Adventures in Memory," which will be mailed free to anyone who requests it. No obligation. Send your name, address, and zip code to: Memory Studies, 555 E. Lange Street, Dept. 870-51, Mundelein, Ill. 60060. A postcard will do.

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Tornadoes, Rockets and Sonja Heine

So far, 1973 has been a banner year for tornadoes. By mid-year, more than 750 of these violent storms had swept down on the United States, killing 59 people and causing millions of dollars in property damage. Scientists expect the existing tornado record of 928 (set in 1967) to be easily shattered before the year is over.

Recently, tornado research has received help from an unexpected source — namely, studies made by TRW scientists of flow patterns in the propellant tanks in ICBM missiles. When you pump fuel out of a liquid rocket tank, much the same thing happens as when you pull the stopper out of your bathtub — a radial flow pattern develops (the particles move in spiral paths toward the center) and a vortex appears. To find out how swirling fluids behaved in propellant tanks, TRW scientists made some fundamental studies of the formation and behavior of vortexes. Further research has extended their analyses to the behavior of the large vortical patterns in the atmosphere we know as tornadoes, waterspouts, dust devils, and fire whirls.

A tornado begins with a thermal instability in the atmosphere, e.g., large mass of warm moist air under a layer of cold dry air. Under such conditions, violent updrafts may begin, around which the surrounding air begins to flow radially inward, in a swirling, spiral pattern. As particles get closer to the center of the flow pattern, their velocity increases. Some readers will recall the startling rotational speeds Sonja Heine achieved as she drew her extended arms closer to her body. Particles of air experience this same increase in rotational velocity as they get closer to the center of the system.

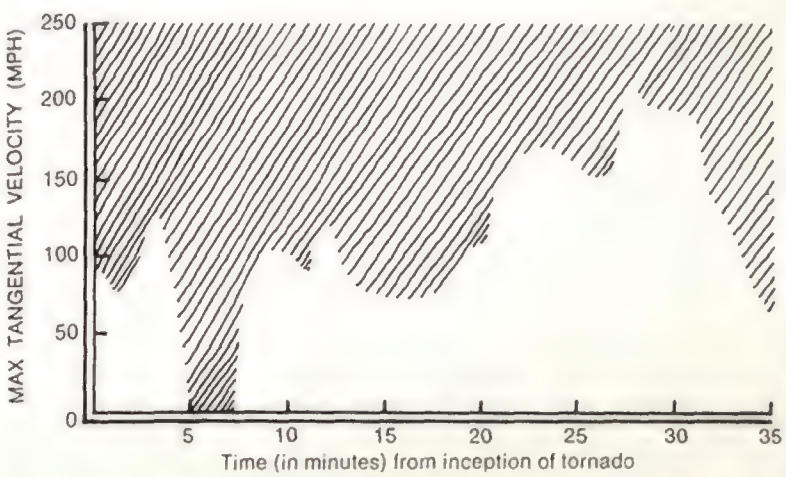
Ordinarily, turbulent diffusion opposes the swirling, and relaxes the disturbance — i.e., friction prevents Sonja from bringing her arms inward. However, in rare circumstances the radial inflow overwhelms turbulent diffusion, and a tornado develops. Actually, in a killer tornado much of the radial inflow is eventually confined to a layer near the ground, because at greater heights the increase of swirling ultimately creates a large centrifugal force that counteracts further radial inflow.

While dust and debris are being swept upward, the funnel of the tornado appears to descend. The latter occurs because the faster the air swirls, the more its temperature drops and the less moisture the air can contain. The resulting condensation of water vapor is seen as the funnel of the tornado, snaking down from the ominous cloud deck. Using these facts, TRW scientists have developed a formula which enables them to calculate the maximum velocity of winds in a tornado.*

TRW scientists have estimated the maximum wind speed in the funnel of a major tornado at around 225 m.p.h. Much of a tornado's destructiveness, however, stems not from the speed of the swirling wind, but from the radically low pressures inside the funnel. As a tornado engulfs a building, air trapped inside the building causes it to explode.

While much remains to be learned about large vortical storms, TRW's work with swirling liquid rocket propellants has lead to an important meteorological understanding of the behavior of destructive rotational storms.

**Maximum velocity, $V = (kgh)^{1/2}$, where h is the altitude of the cloud deck, k the fraction of the distance between cloud and ground the funnel cloud tip has descended, and g the acceleration of gravity.*



Using Weather Bureau data from the tornado of April 2, 1957, TRW scientists calculated the above time-history of estimated maximum wind speeds.

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Since his death in 1865, Americans have raised many monuments to their 16th President—in masterworks of sculpture, in majestic public buildings. Now, there is to be *a unique* tribute to his memory: A series of 24 brilliantly wrought commemorative medallions depicting the great events in Abraham Lincoln's life issued by The Lincoln Mint in a limited edition heirloom collection.

Courtesy Chicago Historical Society

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This series was guided from inception by the eminent Lincoln historian, Ralph G. Newman, and a group of distinguished Lincoln scholars. Medallic designs were created by Lloyd Ostendorf, the foremost Lincoln artist of our day. Medallions will be struck by The Lincoln Mint, recognized by numismatists as one of the nation's finest private mints. These Ostendorf designs will provide a superb medallic record of Lincoln's life from his log cabin birthplace in Hardin County, Kentucky, to his final resting place in Springfield.

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It must be emphasized that, regardless of total demand, only the first 5,000 subscriptions received for either can be honored. Applications received after the 5,000th set for each has been allocated will be returned. Reservations and subscriber serial numbers will be allocated on the basis of postmark date. An early postmark will result in a lower serial number on your medallions—which collectors feel will increase the subsequent value of your set. The earlier your reservation is postmarked, the greater your chance of acceptance.

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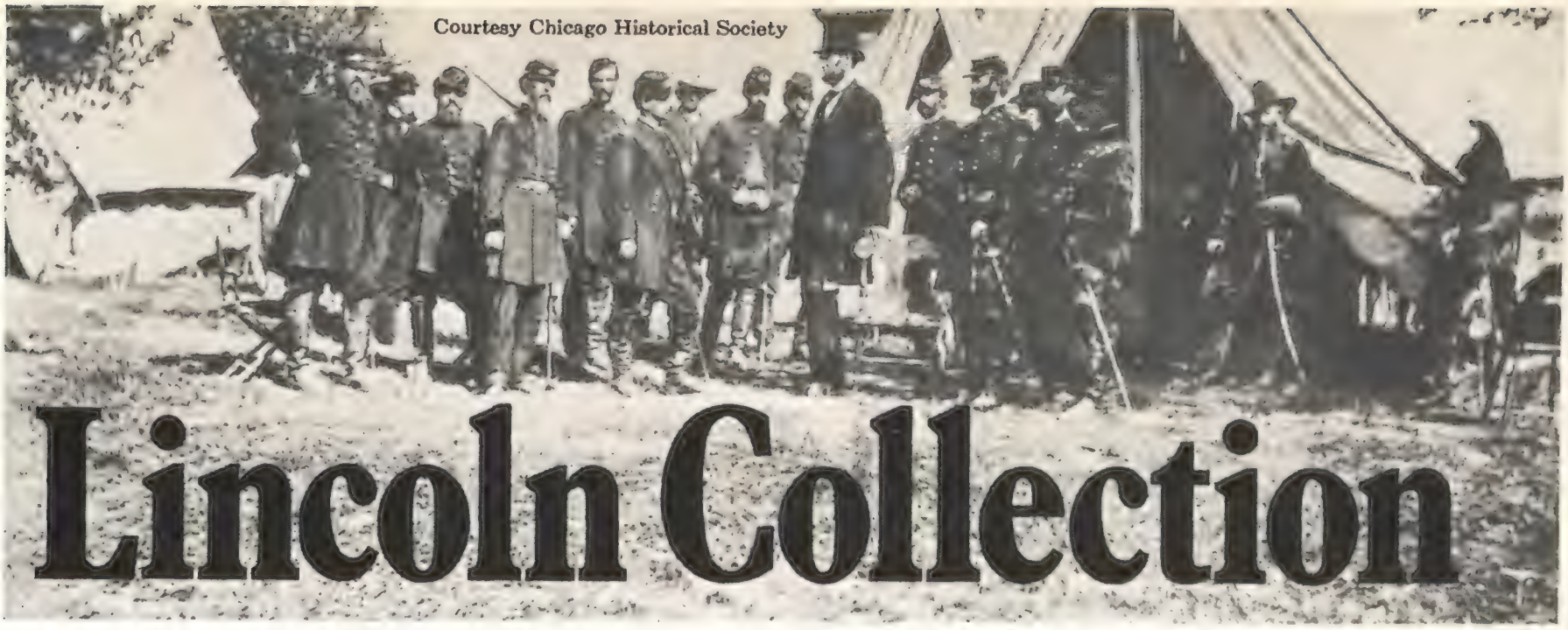

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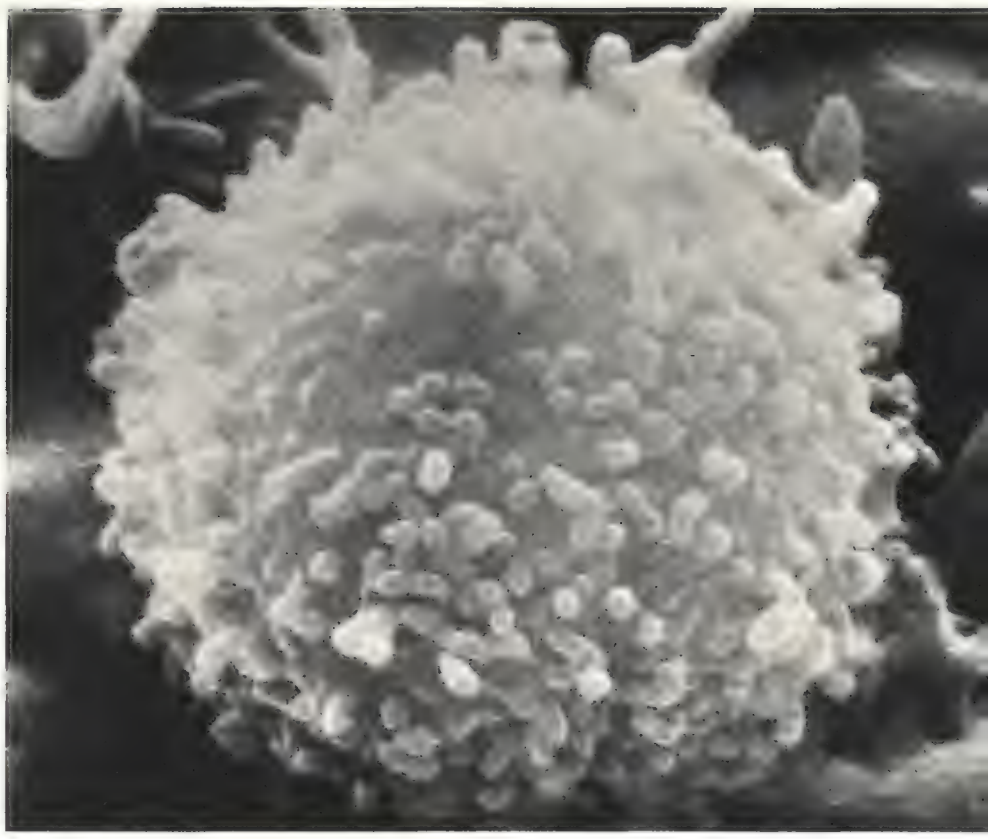
By Harold Schmeck jr.

Body's defenses could be a key to cancer riddle

Doctors find hope in fortifying the natural immune response as a weapon against malignant tumors, but the answer is elusive



Recently discovered warriors in the body's natural defenses, the B cell bristles with villi and the

In mice and guinea pigs, scientists have been able to make cancers diminish or even fade away by deliberately manipulating the animals' own natural immunological defenses. Why can't they do the same thing in humans?

It is a question that any of the 655,000 Americans who will discover they have cancer this year might justifiably ask. There is no simple or single answer, but there is a vast search under way. Doctors in the United States and abroad are already testing new immunologic methods of cancer treatment in small numbers of patients, slowly working through several strategies suggested by basic research.

The immunological system is the body's own defense against an intruder—be it a bacterium, a virus or a transplanted kidney. It probably began to evolve almost as the first living things developed in Earth's primordial soup. These organisms would have required a means of keeping themselves separate from the rest of the soup of organic material around them. (The main components of the human system and some of the roles they may play are illustrated in paintings opposite and on succeeding pages.)

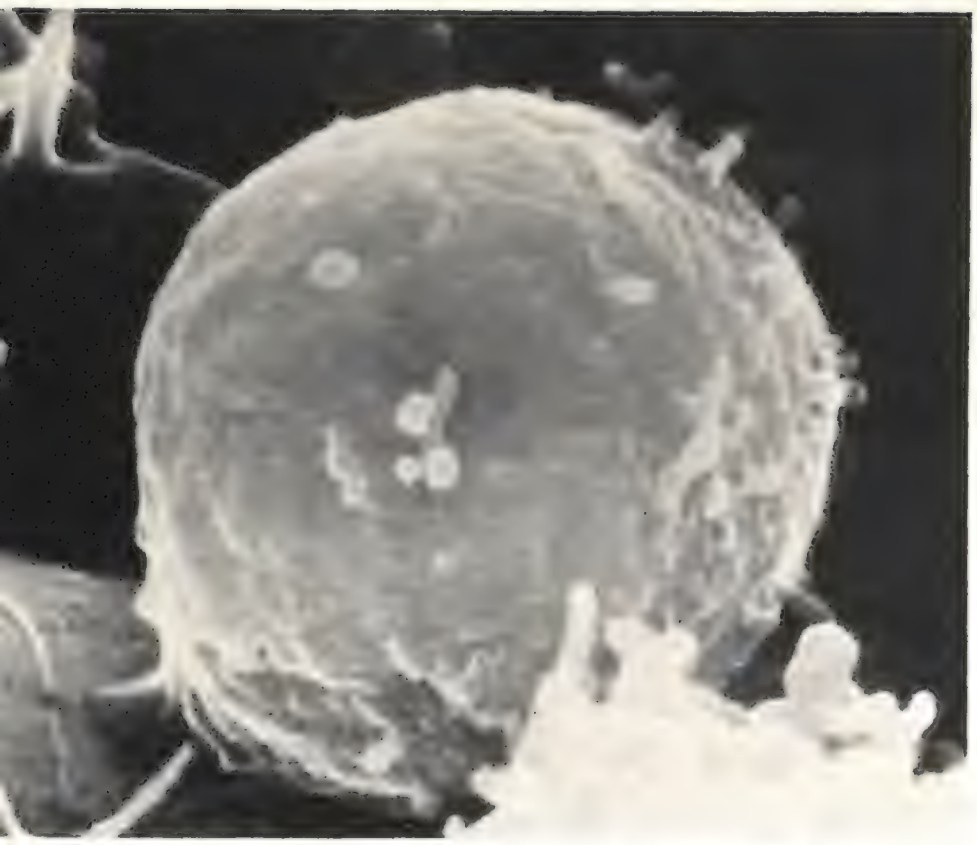
As it has evolved, the immunological system is powerful and wonderfully discriminative. It can differentiate among the three types of polio virus or the many types and sub-types of human blood. And impressive data have been amassed indicating that it can discriminate between cancer cells and normal cells living side by side.

Capable of such fine distinctions, the system would seem a logical way of giving doctors the means to kill cancer cells within a patient while leaving normal cells unharmed. In theory it should be a powerful tool for early diagnosis and even prevention. These possibilities are the promise of the field, and evidence is growing to support them. But today that promise is still largely unfulfilled.

There have been a few thoroughly documented cases in man in which malignant tumors have simply faded away and vanished. Sometimes these disappearances have followed infection or other events that might jolt the immune defense system into heightened activity. The most plausible explanation is that, somehow, the balance between tumor and defenses shifted and the defenses won. So far as is known, this happens only rarely after a cancer has developed and why that should be true is a mystery in itself.

Research during the last decade has established firmly the principle that most cancers in animals are antigenic to their hosts. That is, the cancerous cell will have substances, called antigens, on its surface that the animal's immune defenses can recognize as foreign. There is little, if any, doubt that the same thing is true in man. The human cancer cell will have specific anti-

Harold Schmeck jr. is a reporter for the New York Times. *This article is based on a chapter from* Immunology *which George Braziller publishes this month and which arose from a* Times *series.*



T cell is fairly smooth. They work separately (see diagram below) and together to repel some intruders.

gens that are not present on normal cells of the same kind of tissue.

The results of early attempts at cancer immunotherapy were dismal. Cancer vaccines of various types were tried, and failed. Most other attempts to bolster the patient's natural defenses were wholly disappointing. Some prominent specialists viewed the whole field with frank disfavor. Immunology, for a time, was almost a dirty word in cancer research.

But today the situation is different. Dr. Frank J. Rauscher jr., director of the newly expanded National Cancer Institute, has said repeatedly that he considers immunology one of the brightest long-range hopes of the cancer research field. The men and women who are doing that research know far more about the body's natural defenses than they did just a few years ago. The main classes of immunologically active cells and their functions are far better understood.

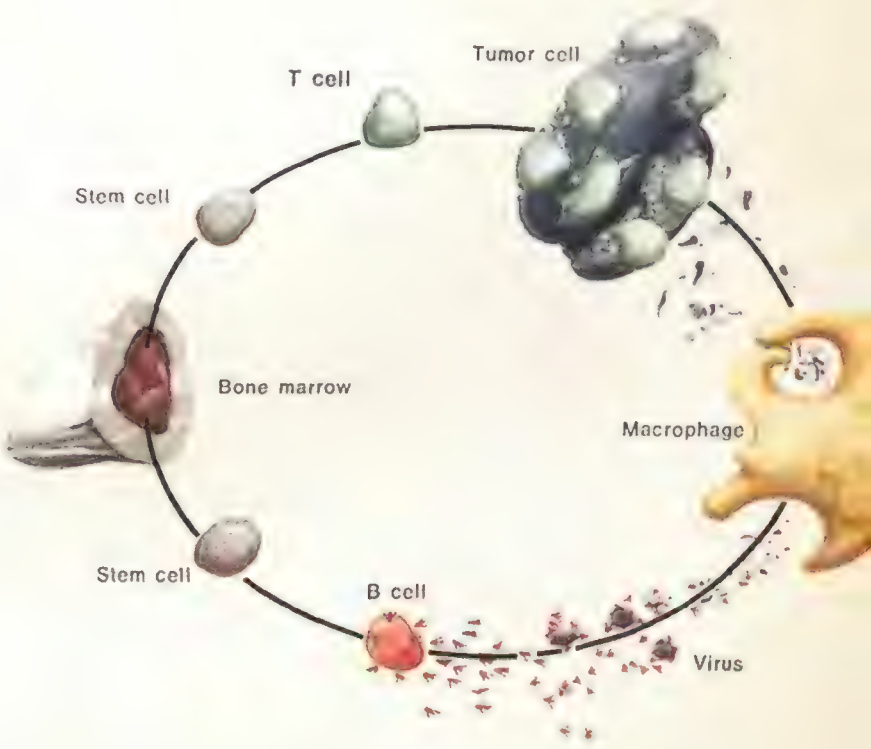
One of these classes is the lymphocytes, cells found in the blood, spleen and lymph nodes (see glossary, page 28). It was only in the last few years that scientists discovered that there are two types of lymphocytes, T and B cells, that each type has distinctive functions of its own and that the two types cooperate as well.

The T cells are sometimes involved in direct attack on anything they perceive as "the enemy." Probably, part of their natural role is that of surveillance against cancer cells arising in the body spontaneously from time to time.

If the T cells could be persuaded to react more powerfully against cancer cells that have already gained a foothold, they might contribute to cure as well as prevention. In fact, there is recent evidence that some strategies already employed to combat cancer with immunology may be doing so through the T cells. One of the current strategies is to use substances called adjuvants to heighten the effectiveness of anticancer treatment. Fundamentally, these are substances which, when injected with an antigen, will increase the immune response to that antigen. There are many kinds of adjuvants, some of which have been used medically for many years. Among them are water in oil emulsions, alum precipitates and the tuberculosis vaccine BCG (for Bacillus Calmette-Guerin), of which we will hear more later.

The new data indicates that many adjuvants enhance immunity specifically by increasing the activity of T cells. Some experts say there is a prime need at present to learn more about how adjuvants work and to develop better ones.

Evidently, the B cells are affected little if at all by adjuvants. Nevertheless, these cells—precursors of antibody-forming cells (see illustration on p. 29)—might also be mobilized more effectively against cancer if anyone could figure out just how to do it. Attempts to produce antibodies were among the earliest efforts to attack cancer through immunology. But present understanding of the problem shows serious hazards in



Two prongs of the immune response: Stem cells from bone marrow can become either T cells that attack alien agents, or B cells that can release antibodies which attack intruders. Macrophages clean up after both.

Paintings by James M. Curran

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antibodies proteins in the blood that can selectively combine with antigens. The antibody reaction to an antigen on a cell surface can bring about the cell's destruction.

antigens substances that provoke a specific immune response in an individual; in short, anything that provokes an antibody response.

B cell a cell derived from progenitors in the bone marrow. B cells in turn mature into antibody-forming cells.

histiocytes scavenger cells which seem to attack the surfaces of foreign cells.

lymph nodes small organs distributed widely throughout the body which serve as filters through which foreign materials that get into the circulation must pass and come into contact with lymphocytes.

lymphocytes immunologically active cells such as B cells and T cells present in lymph nodes, spleen and blood.

macrophages scavenger cells that are capable of engulfing and breaking down a wide variety of foreign substances.

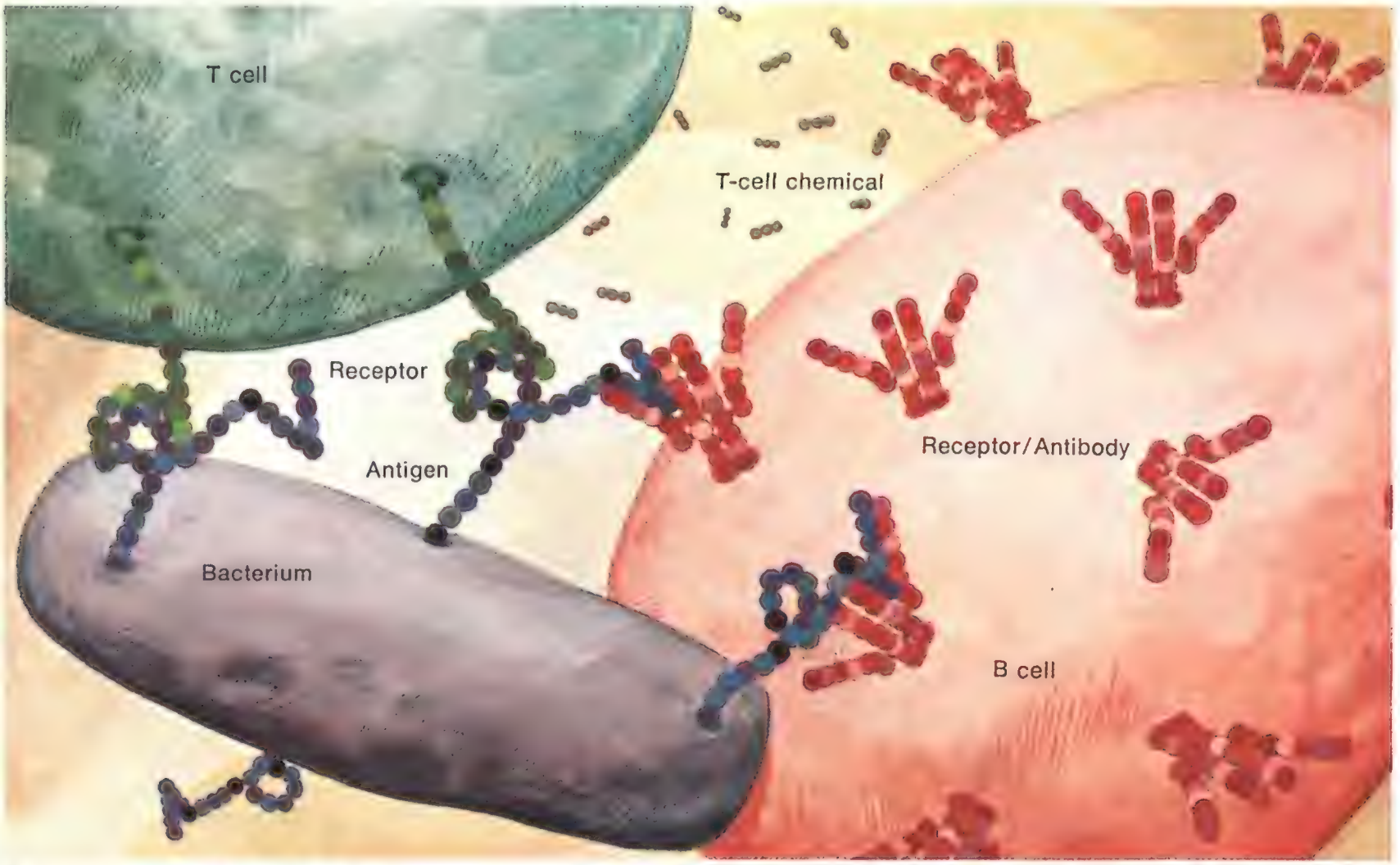
T cell a key factor in cell-mediated immunity. The cells are called T cells because they are acted upon by the thymus gland to achieve their mature state.

this approach: Antibodies can enhance a cancer's growth as well as help destroy it.

The other main class of cells in the immunologic arsenal is made up of histiocytes and macrophages (see illustration, p. 27). Each type, in its own way, can be a killer. The histiocytes seem to work their destructive effects by some action against the surface of the cells they attack. The macrophages literally engulf the enemy. Scientists at Oak Ridge National Laboratory have taken pictures under the microscope showing these killer cells in action against cancer cells. Under their assault, the cancer cells seem to be deteriorating.

In animals with experimental cancers and in cancer patients, however, there is much evidence that the immune defenses are not functioning normally. Patients whose cancers are growing, progressively tend to have somewhat lower than normal numbers of lymphocytes. Such patients seem to have reduced ability to be sensitized by, and to react against, chemicals that ordinarily provoke reactions. Skin tests involving common bacteria also give poor reactions in these people.

Animal research suggests that these are all effects of the very presence of a mass of tumor tissue and that they don't necessarily imply a basic fault in the immune defenses. This is hopeful because it suggests that



Possible tactics of joint attack: While molecules called receptors on T cell and B cell link with antigens protruding from bacterium, T cell releases chemical, stimulating B cell to release antibodies.

just the right nudge to the system, coupled with just the right attack on the cancer, might shift the balance back from defeat to victory.

At the same time, it has been widely observed that persons who have basic immunologic deficiencies and those who must take drugs that suppress their immune systems have a greater than average risk of cancer. These facts stand as complementary evidence that immunology is a key to the problem.

The question is how to grasp that key and the question is a huge one. While it is far from answered, there is emerging a general picture of the way the great defense system functions in the normal person and under the assault of cancer. From this picture, in turn, new ideas are now emerging for intervention against malignant disease.

The body of fact and theory that has focused so much attention on the immunology of cancer was summarized by Dr. Richard T. Smith of the University of Florida, Gainesville. In his view, the basic points that have emerged after years of study in men and animals are these: Generally, animal and human cancer cells have new surface antigens that are recognizably foreign to the body in which they grow.

In normal individuals, the immunologic defense system carries on continual surveillance to detect such danger signs of foreignness and to destroy any cells on which such signs arise. However, once cancer cells escape surveillance and become established as a tumor, parts of the immunologic system become weak or completely ineffective.

After it has started to grow, a cancer deluges the body with a continuous rain of tumor cells and fragments. Many specialists believe this shower of cells and debris overwhelms the defense system.

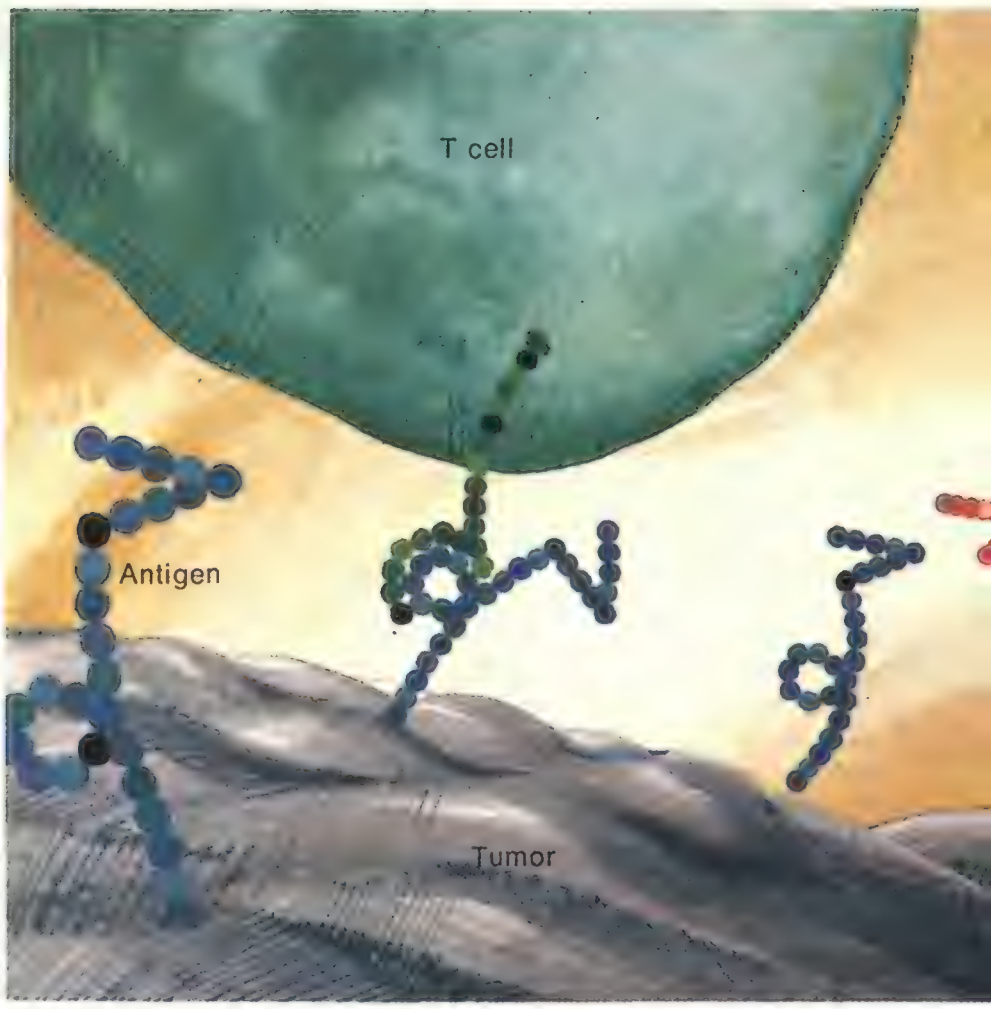
Every part of the defense system that reacts against foreign tissues also reacts against these cancer cells; but, paradoxically, the tumor and the defenses can coexist without destruction of the cancer. Such is the essential picture, parts of it still subject to debate.

Immunologic tests are crucial to the widespread search for viruses that may be among the causes of human cancer. Early diagnosis seems a logical target for a system that appears capable of distinguishing cancer cells from normal ones. If different cancers shed clues to their existence in the bloodstream, this too should be valuable.

The candidate some scientists consider most promising for an early diagnostic test is something called CEA—for carcino-embryonic antigen. It was discovered

Antibody release follows the cooperation between T cell and B cell (upper left and opposite page).

Meanwhile B cells mature into plasma cells that release yet more antibodies to attack the intruders.



Defense against cancer may begin as T-cell receptor links with antigen (left). But tumor may defend

in the mid-1960s by Dr. Phil Gold and co-workers at McGill University, Montreal. Now under study at many centers, it was first thought to occur only in normal embryonic tissue and in cancers of the colon. It has since been detected in other cancer tissues, too. At present its main potential seems to be that of gauging the response to treatment of a person known to have cancer, but some experts still hope for a larger role.

Beyond the uses of immunology in basic research and in diagnosis, there is new enthusiasm for its possibilities in the treatment of patients for whom conventional means have failed.

There appear to be at least 40 medical teams here and abroad making such attempts, according to Dr. William D. Terry, chief of the National Cancer Institute's immunology branch. Fundamentally, the doctors are trying a sort of biochemical judo using characteristics of the cancer against itself and trying, by related means, to strengthen the patient's resistance to his or her own disease. Drs. Herbert F. Oettgen, Lloyd J. Old and Edward A. Boyse—all three of Sloan-Kettering Institute for Cancer Research in New York—have summarized some of the strategies that have been tried or considered.

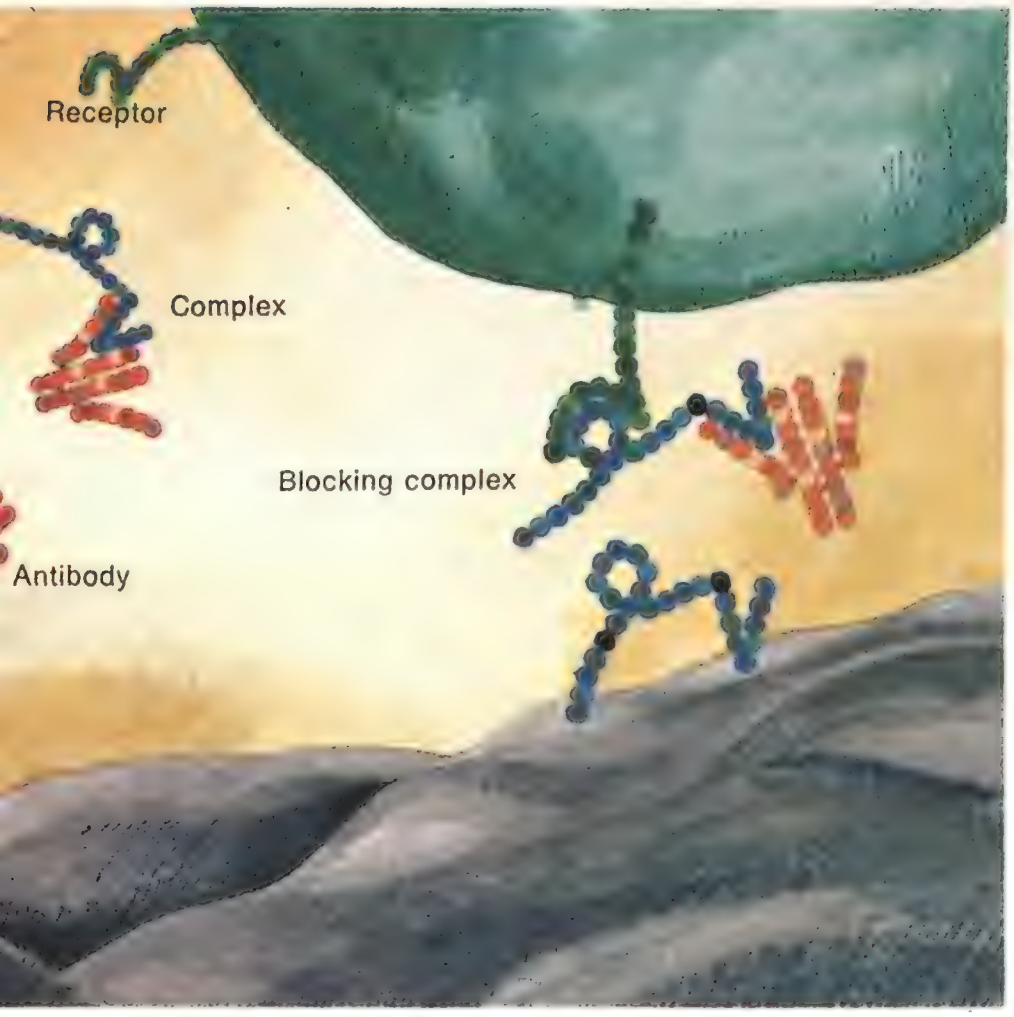
These include attempts to immunize the patient with cancer cells or extracts; to borrow someone else's immunity by transfusion of lymphocytes, their extracts or other materials; to transfer specific cell-killing antibodies from one person to another; to treat the patient with agents that stimulate general immunologic reactivity such as a chemical called DNCB (dinitrochlorobenzene) or the tuberculosis vaccine BCG.

"There are pitfalls in each of these conventional approaches," the authors noted, "and none has yet been shown unequivocally to alter the course of human cancer in a predictable fashion."

Some new variations on the theme of using general immunological stimulators such as BCG are just beginning. Although they can show no definitive results yet, some have already made a dramatic difference for a few patients. For example, at a scientific meeting in 1972, a doctor showed a series of photographs of a breast cancer patient whose disease had reappeared as an ugly cancerous sore at the site of an amputated breast. Pictures during and after treatment with BCG showed the cancer dwindling progressively and the sore healing. The specialist who showed the photographs, Dr. Edmund Klein of Roswell Park Memorial Institute in Buffalo, emphasized that he was not claiming this recurrent cancer was cured. He does claim to have given the patient a lengthy respite from pain and discomfort.

Through this case and several others in a series of more than a hundred, he also claims to have demonstrated the possibilities of a strategy for cancer treatment widely believed to have great potential—in those patients who can be induced to respond. This is the strategy of producing, in the vicinity of the cancer, the cellular immunologic reaction called delayed hypersensitivity—basically the same as the poison ivy reaction although more drastic.

To do this, Dr. Klein applies to the cancer site something known to produce this kind of reaction. One



itself by shedding antigens which form a complex with antibodies which, in turn, block T-cell receptors.

such substance is the compound DNCB. Another is BCG. The belief is that the stimulation provokes a heightened allergic reaction and that this helps the body react powerfully against the cancer tissue as well.

During a period of several years, Dr. Klein has demonstrated that his approach is highly effective against skin cancer and may have some preventive action against its recurrence as well. Several other medical centers have adopted the method. But skin cancer remains a special case. Will the method work against cancers that are remote and inaccessible? The result in some breast cancer cases and others suggest that it might, but the cases have been few and only some of those have responded favorably.

In research with guinea pigs, Dr. Herbert J. Rapp of the National Cancer Institute and his colleagues have provided strong evidence that Dr. Klein's basic strategy is valid. Some experts believe that the research at the Cancer Institute has provided the first clear-cut animal model of immunotherapy, something highly important to future progress in the field.

Dr. Georges Mathé of the Hôpital Paul-Brousse near Paris is using BCG to prolong the outwardly disease-free "remission" period in some patients with acute leukemia. Dr. Mathé uses conventional drug treatment to reduce the number of cancer cells to as small a number as possible and then treats the patient with BCG scratched into the skin. At the same time the patient receives chemically killed cancer cells injected at a site different from that of the BCG. In some patients, this treatment has significantly prolonged the period of remission from the disease.

But the research has also demonstrated that only some acute leukemia patients will respond. For others it does not seem to help. Furthermore, the method depends on conventional drug treatment to produce remission in the first place.

Dr. Donald L. Morton of the University of California at Los Angeles and Dr. Hilliard F. Seigler of Duke University have, independently of each other, produced strikingly long remissions of several years from malignant melanoma (a cancer of black pigment-forming cells) by treatment methods that involve direct injection of BCG into the tumor site.

Raising a cancer's "visibility"

The total number of patients that have been followed long enough for evaluation in both series is still small. In terms of more widespread cancer treatment, the significance is obviously hopeful but still unclear. One difficulty is that melanoma is highly variable and capricious. It can flare up or subside unpredictably for no obvious reason.

It seems firmly established that the tuberculosis vaccine, BCG, can stimulate the body's immunological defense system against a cancer—if there is still enough of the system functioning to respond to it. But the evidence to date suggests that this is by no means always the case.

There are also other methods of making a cancer more "visible" and provocative to the immunologic system. One that is of particular current interest is to treat cancer cells with an enzyme, called a neuraminidase, produced by the bacteria that cause cholera. Two groups of scientists have each demonstrated that mice can be cured of solid cancers when the enzyme is used to increase the "immunogenicity"—or immunologic "visibility"—of the cancer tissue.

Reports on this have been published by Dr. Richard L. Simmons of the University of Minnesota School of Medicine, and a team led by Drs. J. George Bekesi and James F. Holland, then at Roswell Park Memorial Institute. The strategy is to treat cancer cells with the enzyme to heighten their "visibility," treat them also with another substance to insure that they will not grow—and then inject them into the animal in which the same type of cancer is growing.

Dr. Simmons has observed that about a third of the animals treated in this way then react against their cancers and destroy them. The effect appears to be

specific for the types of cancer cell used to stimulate the immune defenses. A different type of cancer growing in the same animal will not be destroyed. Dr. Simmons has begun trying the method in a few carefully selected patients. In answer to a question, he said that the treatment looks promising but that it is far too early to tell how useful it will be.

Another new strategy for cancer treatment stems from research done in recent years by scientists at the University of Washington School of Medicine in Seattle. The key figures in this work are a husband-wife team, Dr. Karl E. and Ingegerd Hellström, and a colleague, Dr. Hans Olov Sjögren.

In a field already plagued by paradoxes, they found one that many scientists consider particularly important. The immunologic defense system, in man and animals, appeared to be producing a specific something that actually prevented other elements of the system from attacking a growing cancer.

This was most clearly demonstrated by research in the test tube. Individuals in whom cancer was growing had in their circulations immunologically active lymphocytes that would destroy the cancer cells in laboratory tests, but not in their bodies. The reasons became clear when serum from such a person was put in the same test tube with the lymphocytes and the cancer cells. Something in the serum blocked the destructive action of the lymphocytes. The Hellströms have called this "blocking factor," which appears to be an antigen-antibody complex (see illustration, p. 31).

In patients, the scientists in Seattle have discovered that the blocking factor appears in the blood serum before the cancer takes a demonstrable turn for the worse; and that it is undetectable in cancers that have been brought under control by surgery, radiation or other means. This suggests that periodic tests for blocking factor in a patient's serum might be valuable in gauging how well he or she was responding to cancer treatment. An obvious further suggestion is that some kind of action to remove or inactivate the blocking factor might be a valuable treatment in itself.

A more recent although controversial finding by the group in Seattle has an even more direct application. Their new evidence indicates that the cancer patient's body can also produce an antidote to the blocking factor—something they now call an "unblocking factor." They have produced some evidence that this can help an animal fight its cancer and recently they have begun the cautious application of this approach to a few selected patients.

The unblocking serum would come from patients whose cancers appeared to have been cured or arrested. The cancers would have to be of the same type as those of the patients to be treated. The Hellströms tried the method in five patients the first year and are now expanding the effort, recruiting 30 to 40 patients for continued studies.

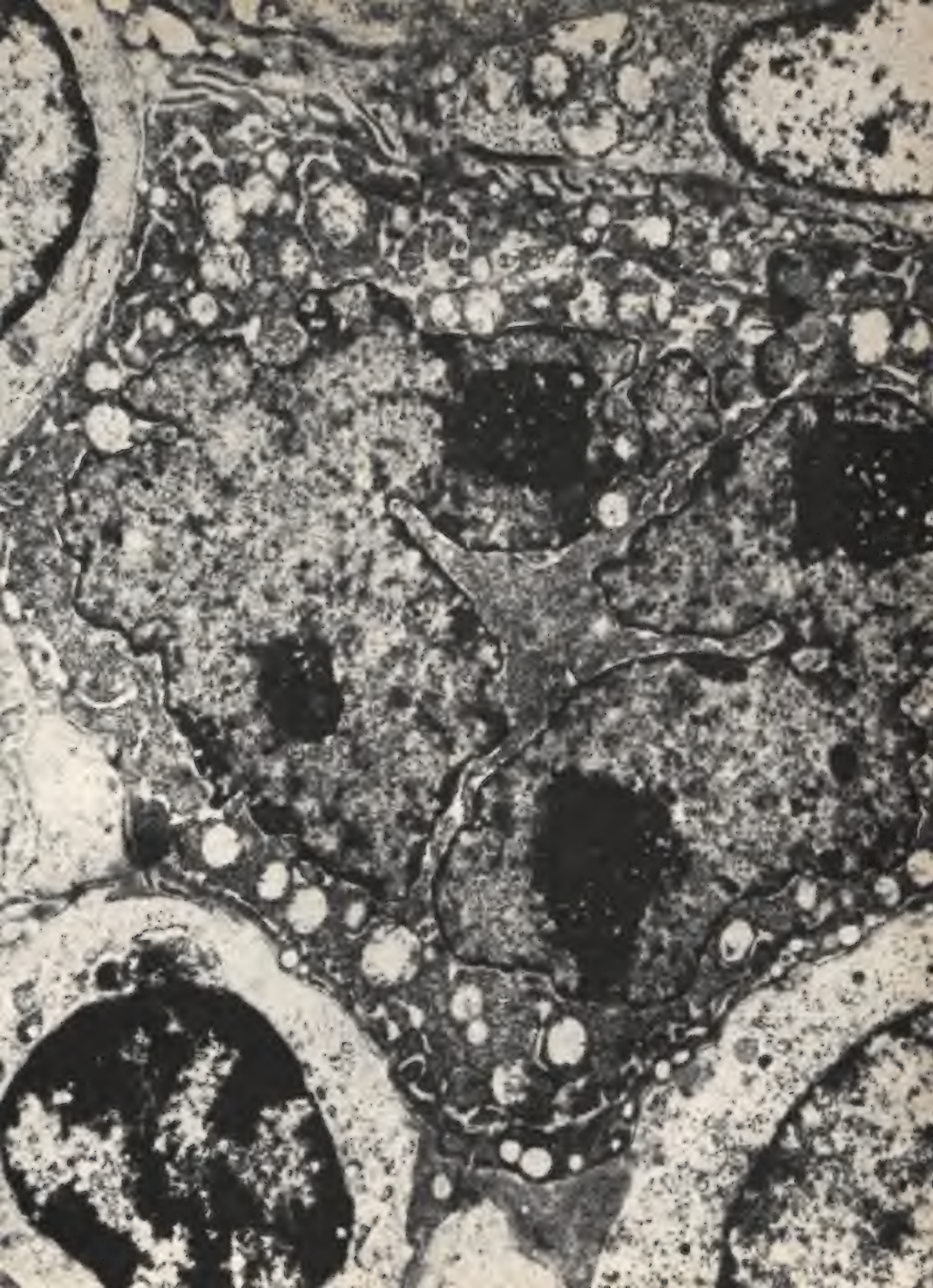
As yet no one knows whether this treatment will be valuable as a cancer treatment. The Hellströms emphasize that they do not consider it ready yet for any use in patients except in the course of a careful study and evaluation on a research basis. There are, of course, potential dangers as well as potential benefits in any new treatment.

All of the new methods of immunotherapy represent ventures to the edge of the unknown. They rest on the mass of basic scientific information that has been gathered in recent years and presumably will contribute to it as well. But while the applications must rest on the scientific base, the attempts to apply this knowledge involve difficult technical, and sometimes ethical and legal, problems. Progress can only be made by confronting these problems.

"All of these methods are likely to fail, but they have to be tried," said one cancer specialist with a blend of pessimism and implied hope that is typical of his field. What he meant was basically this: Cancer is not only a grave health problem, but one of the most difficult and complicated mysteries of biology. It is entwined everywhere with the fundamentals of life itself.

Only by exploring those new leads that appear promising can theories be tested and pieces of the mystery be chipped away. Thus, the defeats of today and tomorrow may reveal the path to a victory thereafter; and no one has any way of knowing how far—or how close—"thereafter" may prove to be.

Ganging up on cancer cell: After the tumor was treated with a drug, histiocytes (the two cells at bottom and one in upper left corner) shoulder in on tumor as lymphocyte patrols at upper right.



By Timothy Green

A great woman astronomer leaves England–again

Margaret Burbidge—Royal Observatory director but not Astronomer Royal—trades a castle for a California viewer's cage

Margaret Burbidge likes to recall that the first time she was truly aware of the stars was on a night crossing of the English Channel when she was four years old. "We slept in bunks on the boat and I felt seasick," she remembers, "so my mother took me into her upper berth and, to distract me, showed me the stars through the porthole. They are so beautifully clear at night from a ship."

From that moment in early childhood she has never lost her fascination with the sky at night. Four decades later she stands out as one of the most distinguished explorers of the mysteries of stars, galaxies and quasars, and probably is the foremost woman astronomer in the world. Moreover, her husband, Geoffrey Burbidge, is himself a distinguished theoretical astronomer, so that together they have become the most famous couple in astronomy. Indeed, their fellow scientists have dubbed them affectionately B^2 (B Square). They complement each other. "Geoff has the ideas," Margaret Burbidge explains, "I do the observing."

These two fine astronomers had forsaken their native England for the clearer skies of California in the early days of the "brain drain" in the 1950s. While radio astronomy in Britain, led by Jodrell Bank's Professor Bernard Lovell and Cambridge's Sir Martin Ryle, was achieving deserved world stature, optical astronomy languished. Therefore the news, late in 1971, that Margaret Burbidge was going to relinquish her job as Professor of Astronomy at the University of California to return home as Director of the Royal Greenwich Observatory, and that her husband also proposed to follow her as soon as a suitable chair could be found for him at a British university, prompted great expectations that together they could breathe new spirit into the flagging state of Britain's optical astronomy.

So, brimming with fresh plans, Margaret Burbidge took up residence at the Royal Greenwich Observatory in July 1972. The Observatory, originally founded by the River Thames at Greenwich in 1675 by Charles II, has made its home at Herstmonceux Castle, near Hastings, for the last 16 years, having forsaken the polluted skies of London for the slightly clearer air of the Sussex coast. Professor Burbidge's office looked out over the ancient moat, populated with carp and Muscovy duck, to the silver domes of the Observatory's telescopes in the parkland beyond.

Her return, however, was not to prove a happy one. The homecoming was marred when she became the first of the 12 directors in the Observatory's 300-year history not to be accorded the additional (but only honorary) title of Astronomer Royal. The posts of Director of the Royal Greenwich Observatory and Astronomer Royal were declared separate when her appointment was announced; subsequently Sir Martin Ryle was nominated as Astronomer Royal. Was the division because she was the first woman to hold the job? Margaret Burbidge, a tall, soft-spoken lady, ducked that graciously.

"It's just a title, not a job," she said. "Don't you think it's good to break tradition?"

She has certainly not hesitated to trample over traditions in her own career. "Geoff and I are not interested in preserving the status quo for the sake of it," she points out. Their careers from the outset have thrived on brushing aside bureaucratic hurdles and antifeminist prejudices. Geoffrey Burbidge has become well-known for speaking out bluntly. As his wife admits, "He's just a man who has to speak his mind." Her prime preoccupation has been to spend as many nights as possible stargazing, and as few days as possible arguing in committee.

The fascination with the mysteries of outer space, first revealed by the clear skies above that cross-Channel boat, has remained. "Throughout my childhood anything glittering at a distance caught my eye," she remembers. "If there was an empty tin can reflecting the sunlight a mile and a half away, I had to go and find it." Starting arithmetic at school, she was intrigued by long numbers with strings of zeros (very appropriate for an astronomer). One Christmas her

Timothy Green reported on the treasures of King Tut's tomb and a unique private zoo in the June and September 1972 issues of SMITHSONIAN.

Photographs by Terence Spencer and Field Enterprises

The first woman director of the Royal Greenwich Observatory, Mrs. Burbidge gave it up after 15 months.

Mrs. Burbidge stands outside Herstmonceux Castle,
where she found politics knottier than science.

grandfather gave her a set of children's books on astronomy by a distant relative, Sir James Jeans, which set her thinking about the immensity of the universe and its secrets.

Yet, although she came from a family of scientists (her father was a research chemist), it never occurred to her that astronomy would be more than a hobby. At school she specialized in botany and expected to take physics or mathematics in college. But when she went up to University College, London, she found they offered a bachelor's degree in astronomy. Naturally she signed on. Only three other students, all men, did the same. "It was not a popular subject," she recalls. Undaunted, she passed easily with first-class honors. It was wartime and jobs in astronomy were rare, but her ability prompted the observatory at the University of London to offer her a research assistant's post, while she worked for a Ph.D. Most of the telescopes were out of action, but one was still in use, so that she could put in long nights stargazing. Since London was blacked out for the war, the viewing was good.

A search for clear skies

Her skill with the telescope so impressed her professors that after the war she soon became assistant director of the observatory. But peace brought its problems: Street lighting came back and traffic fumes blurred the sky at night around the telescope at Mill Hill on the fringe of London. "I began to realize that if I really wanted to do observational astronomy, I'd have to leave the country," she says. In 1949 with physicist Geoffrey Burbidge, whom she had just married (and won over to astronomy), she obtained permission to use a 36-inch telescope at Provence in the south of France during a vacation. They had no grant to support their work, so they just took the train and sat up all night since they could not afford sleepers. In Provence someone loaned them a couple of bikes to get around on. "That month," says Margaret Burbidge, "was a revelation. After England the sky was so *clear*."

Now determined to seek fairer climates, both applied for posts in the United States. Margaret wrote to Otto Struve at the University of Chicago's Yerkes Observatory in Williams Bay, Wisconsin. "He was my hero," she said, "because he worked on hot stars with extended atmospheres, which was my specialty." She landed a $1,000 International Astronomical Union Grant to go to Chicago; her husband obtained a $1,680 Agassiz fellowship at Harvard. So they split their time between Chicago and Boston. The real joy, however, came at Christmas, when they both went down to southwest Texas to use the 82-inch McDonald Observatory telescope at Fort Davis. Because most other astronomers did not work over the holidays, they were able to obtain the otherwise heavily booked equipment. Christmas night was spent looking at the stars.

After a brief return to Cambridge, England, the Burbidges set up permanent housekeeping in the United States in the fall of 1955, when Geoffrey won a Carnegie Fellowship at the Mount Wilson and Palomar Observatories. (Housekeeping is fairly vestigial—they eat in restaurants.) The fellowships were then not open to women, so Margaret had to settle for a research fellowship at Caltech. Other antifeminist rules impeded her work. As a woman she was not permitted observing time at Mount Wilson Observatory. Her husband had to apply and she had to go along as his assistant. Even then she was not allowed to use the dormitory on the mountain top, so they had to camp out, sometimes in the middle of winter, in a primitive summer cottage heated only by a wood-burning stove. After an all-night session at the telescope they would often trudge through waist-deep snow and try to kindle damp logs into a blaze to boil the kettle for tea. The Burbidges tolerated this no-woman rule for a while, then challenged it—and won.

Since then, if not a card-carrying member of women's liberation, Margaret Burbidge has always striven to see that astronomy offers just as many opportunities for women as for men. At the University of California she campaigned with the late Nobel prize-winning physicist, Maria Goeppert-Mayer, for the university to hire more women.

In 1971 she declined the American Astronomical Society's Annie J. Cannon prize given for notable work by women in astronomy. (Annie J. Cannon was one of the finest women astronomers in America. She specialized in cataloguing the spectra of stars, but because she was a woman she was not credited in the catalog.) Margaret Burbidge turned down the award because she felt it inconsistent to campaign for an end to discrimination against women in astronomy and at the same time accept a prize available only to women.

Element synthesis in stars

The hurdles for women in astronomy did not, however, prevent her progress. Her first significant breakthrough came in 1957. Her painstaking spectral analysis of the varying abundance of certain elements in different stars enabled the Burbidges, in collaboration with nuclear physicist William Fowler of the University of California and astrophysicist Fred Hoyle of Cambridge University, to propound a totally new explanation, christened the B^2FH theory, of how heavy elements are formed through nuclear reaction in stars.

Margaret Burbidge next began to probe the nature of galaxies, those millions of star systems far beyond

Geoffrey and Margaret Burbidge at home with their daughter Sarah, who has no plans to be an astronomer.

our own Milky Way. "They are the building blocks of the universe," she says. "We want to know how many there are, what is their history, how they relate to the evolutionary system."

The answers are slow in coming. The solution to one problem seems only to open the doors to others. "It's a bit like playing chess with nature as your opponent," she explains. "You make a good move, but nature counters with half a dozen new ones."

She has also been delving into one of astronomy's greatest mysteries—what is the true nature of quasars. First identified in 1963, the quasars (short for Quasi-Stellar-Radio-Sources) are objects that can be dimly picked out by optical telescopes, but usually come in strongly on radio telescopes. These radio signals are much stronger than anything emitted by a normal star. Once quasars are properly understood, they may stand some conventional theories of astronomy on their heads. To begin with, the quasars seem to be a tremendous distance away—the nearest about 1.5 billion light-years or more (one light-year is the distance light travels in a year, or about six trillion miles). For quasars to be visible at all at such distances, they must be as bright as trillions of suns. Lines in their spectra are shifted toward the red end of the spectrum; this "red shift" is very large and, according to traditional theory, indicates they are receding into the outer vestiges of space at a great pace. But are they really receding? And are they truly so far away? Why does their red shift vary so much?

"Quasars are real brainteasers," Margaret Burbidge says. "They are a new class of objects. The nature of their red shift is all up in the air." Her own working hypothesis of why the red shift varies is that the quasars are pumping out clouds or puffs of gas that move at different velocities and thus have different red shifts. But how? And what unknown physical process makes these distant, relatively small objects such fantastic sources of energy?

The ultimate answers may provide us with a completely new hypothesis on the nature of the universe. But she believes there will not be a swift denouement. "I just don't see an easy solution to the problem of cosmology," she said. "I think it's misleading to talk in terms of two simpleminded cosmologies (the rival steady-state and big-bang theories). I think we shall find the situation is very much more complicated. There are so many things that don't fit. Perhaps the answer may be something akin to a hierarchical universe—meaning that there are epochs of galaxy formation that approximate a big bang."

Her preoccupation with unraveling these mysteries made it surprising that she should have departed from

California to return to what was essentially an administrative job behind a broad desk in a 15th-century English castle. As she readily admits, she is happiest at night perched in the observer's cage of some giant telescope trained into the outer depths of space. "I like big telescopes," she confides, "as big as I can get my hands on." The task of coordinating the work of an observatory and sitting on endless committees did not seem right for her. And when I went down to Herstmonceux one day this past summer to meet her, I asked why she had come back to cloudy Britain.

"I took it as a service job," she explained. "For years I've been a user of telescopes that others have put hard work into producing, so I felt it was time I did some of the organizing myself. And it is decades since there was anything reasonable here for optical astronomers to work with, so I wanted to try to provide good facilities for the young British astronomers. I envisage it simply as two years' leave of absence."

Her reign as Lady of the Manor at Herstmonceux Castle got off to an active start. She quickly learned that the castle's splendid 380 acres of parklands and gardens, rich with rhododendrons, magnolias and roses, were open to the public only on weekdays. She changed that to include weekends. She also forbade all fishing in the moat and lakes, and stopped hunting—the previous director and Astronomer Royal had led an annual shoot.

But her real tasks were twofold—first, to step up work on a 150-inch telescope in Australia that is due for completion in 1976 and, more significant, to try to hasten the creation of a Northern Hemisphere Observatory, headquartered in Britain, but with its telescopes in a more favorable climate.

Modern telescopes are simply wasted in Britain because of its climate. A report prepared for Margaret Burbidge at Herstmonceux revealed, for instance, that the Royal Greenwich Observatory's own 98-inch Isaac Newton telescope (the fifth largest in the world), can be used for a mere 600 to 800 hours a year compared with the 2,100 to 2,500 hours for telescopes in the more favorable climates of California, Arizona and Chile.

"I haven't been able to use it at all myself," she told me, "because, even if the weather is fine, the sky here is not transparent enough for me to observe the galaxies and quasars that interest me."

Where to move the telescope

She spent much of her time at the Observatory providing her own specialized knowledge on ideal locations for the telescope and for others proposed for the Northern Hemisphere Observatory. The requirements are stringent. "The best place for a telescope is in a clear climate, far from pollution, and at an altitude of between 5,000 and 9,000 feet," she explained. "Then you need a steady atmosphere, because hot and cold ascents and descents can blur the image. You are really looking for an empty place away from civilization, where the prevailing wind comes off the ocean." The perfect candidates in the Northern Hemisphere are the West Coast of the United States, Hawaii and the Canary Islands. But persuading the British to locate telescopes there is another matter. Scientific logic tends to be overridden by politics. An astronomer's proposal that Tenerife in the Canary Islands would be grand for an observatory may well be countered by a bureaucrat's suggestion that wouldn't the British-owned Rock of Gibraltar do just as well?

That was not the only difficulty. Margaret Burbidge's vision for the Northern Hemisphere Observa-

tory is that it should be an outfit akin to, if perhaps not as big as, the U.S. National Observatory in Arizona.

"You really should involve the physicists, developing all kinds of new instrumentation, as well as observational astronomers," she argued. "Mix these together in one place and I believe you could interest many of the people of world stature in optical astronomy who've retained their British nationality and are interested in developing things here for future generations." Sadly, however, she finds they are being ignored. "They are not being tapped," she complained. "They ought to carry a lot of weight in the deliberations of the future, but there's a tendency to push them all on one side and not call on them. I think it's a great pity."

Her husband was more forthright. When a university post in England acceptable to him did not materialize, Burbidge began firing broadsides from across the Atlantic, where he had remained in residence in California. In a brusque letter to *Nature,* the British science journal, he said it was time to lay bare "a few home truths" about British optical astronomy. "While radio astronomy and theoretical astronomy are in reasonably good shape in the U.K.," he wrote, "optical astronomy, as it is currently practiced in the British Isles, is only third-rate." He listed, among other problems, the location of the Isaac Newton telescope in Britain instead of abroad in a better climate and the refusal of the British to join in the European Southern Observatory project in Chile. The only solution, he argued, was the swift creation of a new organization, based in Britain, with an observatory for optical and infrared work "second to none" abroad. The talents of expatriate British astronomers now working in the United States should be called on to help in the project, and other international experts should be recruited. "For it must be grasped," Geoffrey Burbidge added, "that much as the British prefer themselves to foreigners, foreigners and particularly Americans lead in this esoteric field."

Such cuts from abroad were hardly received kindly by British astronomers, and made it even more unlikely that he would be welcomed back to academic circles here. Meanwhile his wife's own campaigning was getting slowed down in bureaucratic delays. "It's frustrating when you see things not going as fast as you had hoped," she admitted to me. "In the States one man essentially started the interest going for a national observatory; it wasn't hard to get some support and get under way, and you could raise money privately. Here there seems to be an endless committee structure."

These tedious committees, coupled with political squabbles, soon disillusioned Margaret Burbidge. As she admitted shortly after her arrival at Herstmonceux, "It's quite repugnant to me, actually, the political infighting and so on; it upsets me, I really don't like that and I couldn't take much of it." And when we talked this summer, she confided that if things did not swiftly improve, she would simply pack her bags and return to California, where her professorial chair had been kept open for her.

Sure enough, in October she announced her resignation, after only 15 months at the Royal Observatory. In her letter of resignation she stated bluntly that the rebuilding of optical astronomy in Britain needed the collaboration of many expatriate scientists. "I never intended to return to the United Kingdom in isolation," she added. But since her husband had not been able to follow her to help share the work load, and plans for the Northern Hemisphere Observatory along lines that would tempt others to return to Britain were not maturing to her satisfaction, she felt she had to leave. "I guess we feel we're not particularly welcome," she admitted sadly, on the day of her resignation, "and that by leaving Britain [in 1955] we somehow forfeited our right to come back." And her husband chipped in. "The whole thing is a mess—we certainly tried and we certainly failed."

To anyone who knows Margaret Burbidge, her withdrawal is no surprise. Back in California this winter she can look forward to those crisp, clear nights she loves. "You know," she said to me, as we walked out through the elegant old courtyard of Herstmonceux Castle shortly before her return to America, "what I really enjoy is astronomy."

Margaret Burbidge freely admits she is far happier in the observer's cage of a giant telescope, as here in the 120-inch at the Lick Observatory, than she is behind an administrator's desk.

1974 A.D.
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Text and photographs by Howard Sochurek

What it is like to live in Siberia during winter

Despite metal-cracking, skin-stripping cold, Russians now send themselves to their old land of exile to seek profits in the permafrost

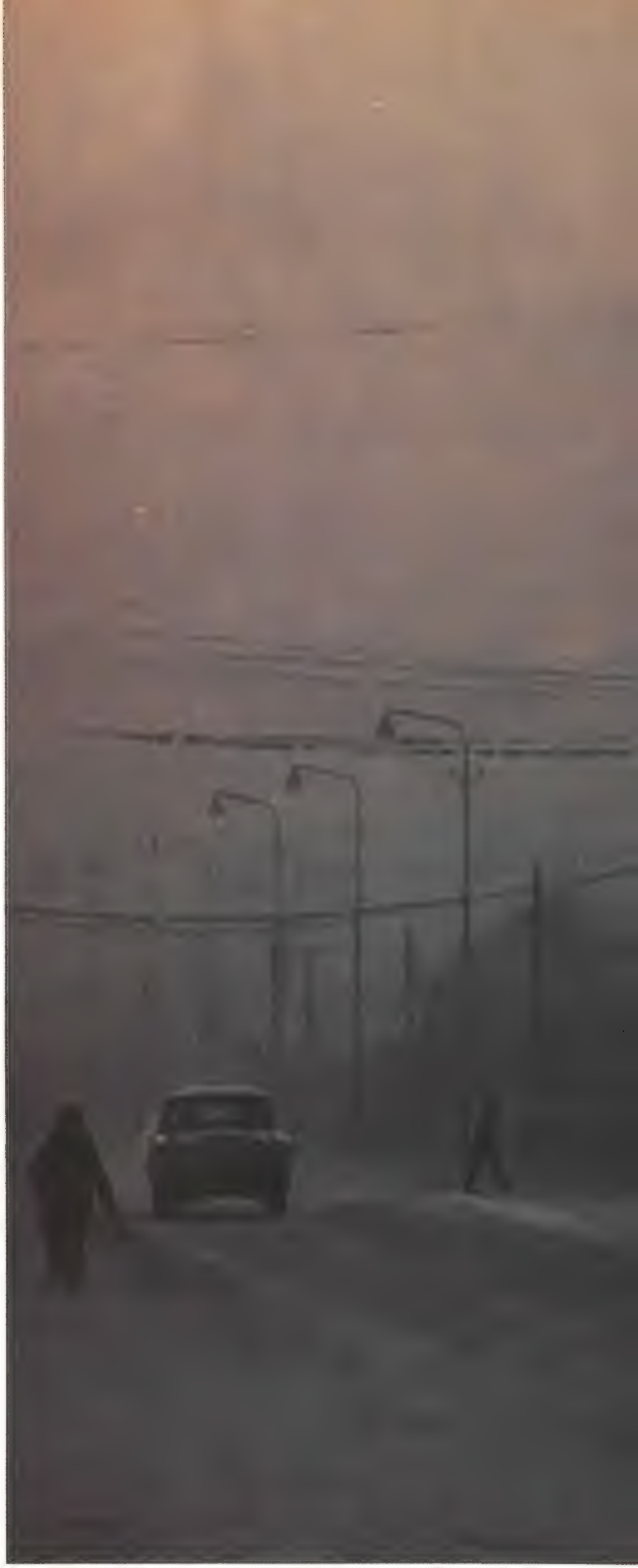
In winter, Havre, Montana, is cold and so is International Falls, Minnesota, and the Lofoten Islands of Norway and Ulan Bator in Mongolia and Sunchon, North Korea. I've been to those places, but I've never been so stone-cold as in the northern reaches of Siberia.

In the old days in Russia it didn't matter much what happened to political prisoners exiled to "the land of the dead," as Siberia was called. If they survived the long trek (some walked for two years to get to their destinations on the Angara or Yenisei or Lena Rivers), they holed up for the winter in a wood-fire heated log cabin, hibernating, sleeping for days on end much like the huge Siberian brown bear.

Today it does matter. New-found oil and gas deposits, iron, coal, gold and diamonds, have lured tens of thousands of "new Siberians." Some jobs like oil drilling can only be done on the coldest days of the year. The oil at Surgut (see cover) and Samotlor (two fields that are even larger than Alaska's North Slope) lies deep below an endless bog. When spring comes the roads go out and work stops until the fall freeze.

Most of Siberia is covered with snow for six months of the year. Rivers are frozen solid for all but three months. In Yakutia there are only 90 frostless days. At Verkhoyansk in the Yakutsk Autonomous Soviet Socialist Republic the average temperature in January is −50 degrees F and sometimes drops to −90 degrees F.

During my recent month in Siberia, in the dead of winter, I found that weather dominated all other aspects of my assignment. Mere survival in the cold



Yakutsk at high noon is wrapped in "human fog"—frozen condensate from houses, cars, just breathing.

To Siberia by choice, not exile

Bundling up for 40 below in Novosibirsk, Siberia's "Chicago." Cheap electricity runs trolley buses.

became for me more important than the job I was to do. My first stop was at Nizhni Vartovsk, an oil boomtown in northwestern Siberia. Temperature: —52 degrees F. There Samyon Kuzovatkin, the chief geologist at Samotlor, taught me the first lesson of survival: proper dress. Kuzovatkin gave me a Siberian wardrobe: for the feet, *valenki,* black pressed-felt boots. Cotton cloth wrapping rags came with the boots, and I bound my feet, ankles and legs up to the knee. A two-piece, fur-lined pants jumper and a huge, furry, hooded parka came next. Both garments were black-dyed leather with the fur (black rabbit) turned inside.

For my head I received a *shapka,* also fur-lined, with sidepieces that covered the ears and turned down to collar height, a fur visor that covered the forehead and flaps that could be tied under the chin. For my hands I was given two sets of gloves, *perchatki.* The inner gloves were silk, the outer fur. All of this gear was to be worn over normal winter clothing—pants, coat, wool socks, flannel underwear.

As we proceeded to the oil fields near Samotlor, Kuzovatkin told me of some of the problems of working in the cold. His drill teams work only 50 minutes of an hour. The remaining ten minutes are spent in a warm-up shack. As we passed through a town he pointed out "human habitation fog"—an icy mist formed by warm moisture from bodies and buildings, cars and carts, condensing in the freezing air. At —30 degrees F schools close. It's impossible for children to wait in the cold for their buses. At —40 degrees F open-air work stops as steel becomes brittle, metal untouchable, brake fluid freezes and most lubricants clog. For automobiles, special batteries are installed, kerosene is mixed with engine oil and winter tires of soft rubber replace normal tires. Every vehicle has a double windshield with a sealed air space to prevent frosting and fogging.

I kept my cameras under my outer coat to protect them. As soon as I brought them out, however, moisture would condense on lenses, making photography impossible. If I kept them outside, the metal parts would become so cold that when I lifted one to my face, skin froze to it and it had to be literally ripped off.

I could take only 15 minutes in that cold, and it was all the film could take too. After about 15 exposures and 10 minutes of exposure, the sprocket holes on the film edges became brittle and tore out. I could do nothing but head for the warm cookshack.

One of the *burilshchikii* (oil well drillers) warming in the shack told me that throughout the oil fields there are natural gas burn-off outlets. Huge burning gas flares belch flame and black smoke across the skyline. The fields lie just on the flyways of migrating Arctic geese and in early winter, attracted either by the

Mr. Sochurek photographed color-coded x rays in last August's SMITHSONIAN. *Long a foreign correspondent, he has spent much time in the USSR.*

Kindergartens such as this one at Bratsk offer food and board for children to encourage population.

light or the heat, huge flocks of geese pass close to the flames. Hundreds come too close and fall helplessly into the snow around the flares, providing a free source of winter meat.

Because of the severe weather it is hard to attract labor to Siberia. Incentives include a "northern bonus," 40 percent over "Moscow pay." After that, ten percent is added for each year a worker stays on the job. It is not unusual for oil workers in Siberia to get 1,000 rubles a month while their counterparts at Baku are only making 200. Women are given a special incentive to settle and reproduce. No stigma is attached to the unwed mother—the state gives her special encouragement. At the *dyetskii sad* or kindergarten, a 24-hour, seven-day school and boarding service is available for children of working parents and unwed mothers. A child with father and mother pays 40 rubles monthly, a child of an unwed mother receives the same care for only four rubles a month.

To me, the elite of Siberia seemed to be those who had conquered the cold: trappers, reindeer herders,

Horse-drawn sled takes about ten hours to cross Lake Baikal and thus link its fishing villages.

To Siberia by choice, not exile

foresters, geologists, roughnecks, construction workers. I talked to one such happy Siberian, naturalist Simeon Ustinov in Irkutsk, about survival in the forest. He told me of how last year he had almost been killed by a *shatun,* an angry bear, that had silently stalked him. When the Siberian bear prepares for hibernation he builds three winter caves. If he is disturbed, he goes to the next one. But three disturbances make him an enraged *shatun,* on the hunt for humans.

In the southern taiga—a swampy coniferous forest—frequented by fur trappers, log huts are scattered a day's journey apart. These are warm and stocked with food and frequently attract bears. Often a trapper has to dispute possession of a hut with a bear. Ustinov told me of one trapper who worked for nearly a day to lure or scare a bear out of a cabin with food, fire and gunshot. Firebrands finally drove him out, but also burned the hut down.

Ustinov told me that woodsmen always travel by twos in Siberia and often must sleep without shelter because of the sparse population. At −30 degrees F he builds two fires, digs a hole in the snow between them, and beds down there in his sleeping bag. There is a rule that if you are lost in the cold you must stay where you are, build a shelter and wait for rescue.

To help Siberians survive the boredom of cold sunless days (at Yakutsk even at midday the sun hugs the horizon), there are satellite receivers, 30-foot dish antennae, that capture Moscow TV signals. Because of the time difference, Moscow programs are taped in the local radio and TV center, then replayed. Even the two-room range cabin of Chimit-Tseren-Gomboyev, close to the Mongolian border, has a TV set and refrigerator. But to keep warm at night he and his family sleep atop their stove, or *pechka.* This has a huge plastered-brick square bottom, waist-high, containing a wood-burning firebox. Above this, another cube

Sheep by the thousands graze collective farms of the Buryat Republic, near the Mongolian border.

Reindeer serve the Evenks tribal group of Siberia's eastern goldfields. They will outrun horses.

Underground studies at Yakutsk Permafrost Institute led to placing heated pipelines above the ground.

Pony fur covers under sides of reindeer herdsman's skis; otherwise cold would penetrate his boots.

Manager of fur farm raises 1,200 mink and sable. Siberian furs earn USSR 40 million rubles per year.

holds the oven and reaches to within a few feet of the ceiling. And on top of the oven, in front of the chimney, is a broad shelf—the best and warmest sleeping area in the house.

Siberians also keep warm by doubling doors and entryways. You enter a Siberian cabin through a small hall with a wood-burning stove. Here, where the temperature is just above freezing, you remove your boots and outer dress. The adjoining inner rooms are heated by the central stove. Possibly the people who best survive the Siberian cold are the members of some 20-odd tribal groups, the descendants of Chinese and Mongols. They are the Buryats and Evenks, Yakuts, Yukaghirs, Mansi, Khanty and many others. Most are reindeer herdsmen and some still live in "yurts" or "chum" as their round skin-covered tents are called. One tent I visited in the Yakut Republic was double deerskin pitched over a frame of bone and bamboo. Here, too, an outer hall acts as storage room and heat lock. The main room was about 15 feet in diameter with a wall-to-wall carpet of dozens of furry, thick, soft reindeer robes. A small iron stove sat in the center, the only furniture. Everyone sat or squatted on the soft reindeer skins.

Through my interpreter I learned about the village storyteller who entertains the herdsmen through the long winter. A favorite story was about *Nurgun*, a one-legged, one-armed cyclops who roamed the Arctic and could fell an elk with his fist or crush a rock in his grip. Storytellers sit for hours around the wood stove, talking all through the night, inventing new and more colorful stories. They change meter and the tone of their voices to portray heroes, old women, evil spirits or young lovers.

In some parts of Siberia there are more reindeer than people and they, too, play an important part in survival. After long negotiations I was able to charter an Aeroflot helicopter, and a 40-minute flight took me to the Evenks camp at Namnir, where a 93-year-old herdsman, Ivan Pavlov, met the flight in his reindeer-drawn sleigh. He was wearing reindeer-fur coat, reindeer boots, reindeer gloves and a reindeer cap.

The Evenks believe in Shamanism or spirit worship, invoking the "spirit of the deer." In the yurt that was base camp for a herd of 1,600 reindeer, I learned that reindeer provide every need of these tribal people. Reindeer meat is their main food, hides provide shelter as well as clothing. Even the hair is used for mattress stuffing. In reindeer sleds, it's not unusual to cover 100 miles in a day. The animal can run at twice the speed of a horse.

In spite of the isolation, the cold, the hardships of travel, I found Siberia strangely attractive. A story is told in Tyumen, the booming oil-exploration capital of western Siberia, of a young boy from the Yamal Peninsula in Siberia's far north who won a contest and was given a trip to Moscow. On his return a reporter asked him "What do you think of Moscow?" expecting him to be impressed with the crowded traffic, tall buildings, Red Square, Lenin's tomb, the Kremlin. All he answered was *"Sibir luchshe* (Siberia is better)."

At one ruble per flower, this vendor in drab Novosibirsk makes a handsome income.

Busy life of a Samotlor oil field at 50 below produces thick human fog holding at treetop level.

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This is Exxon's uranium mine in Wyoming. When the surface mining is completed, most of the area will be filled in, contoured and planted to match the rest of the countryside. Grass, wildflowers and shrubs that Exxon planted are already growing on much of the earth that has been excavated from the mine.

Making nuclear power more plentiful.

Exxon is currently working on several projects to expand the availa-

to know

An engineer at Exxon Nuclear Company shows a young visitor how a fuel bundle is assembled. Dozens of zirconium or stainless steel tubes are filled with uranium pellets, then grouped together to form a nuclear fuel bundle. As many as 600 bundles make up the core or heat source of a reactor.

bility of nuclear energy.

One involves the use of plutonium to conserve uranium ore. Plutonium is a by-product of today's commercial nuclear reactor. By substituting plutonium for uranium, the same amount of nuclear fuel can be produced while saving uranium.

In another project, Exxon Nuclear and General Electric Company have announced a joint study of the technology and economics of uranium enrichment by private industry.

All enrichment is now done by the Atomic Energy Commission. As the demand for enriched uranium grows, private industry may take on part of this job.

What's delaying nuclear power?

Today only 5% of America's electrical power comes from nuclear plants. The figure is small because the construction of new plants has been delayed. Environmental objections, labor shortages, technical problems, late deliveries of specialized equipment and changes in regulatory procedures have all taken their toll.

As these matters are resolved, we will begin to depend more and more on nuclear energy to produce the electricity to run our factories and heat and light our homes.

Making America more self-sufficient as an energy-producing nation through the wide use of nuclear power will not be an easy job. But Exxon believes we need to reach this goal as soon as possible.

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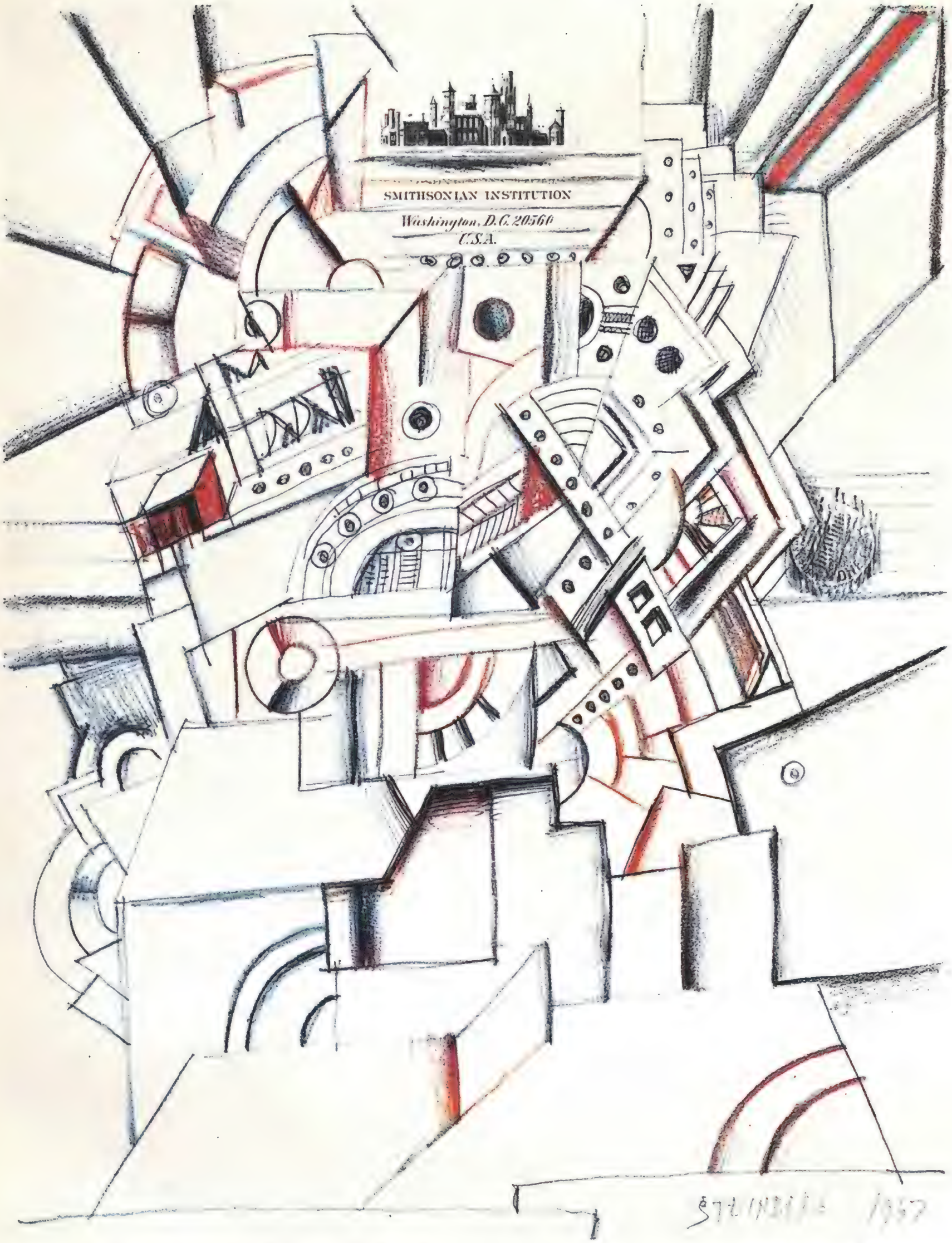


A sheet of Smithsonian stationery (shown in reduced size) is embellished with cubist and Art Deco motifs.

All drawings © 1967 by Saul Steinberg

By Jay Jacobs

Saul Steinberg revises the 'castle'

As artist-in-residence at the Smithsonian, the famous cartoonist gave the official letterhead stationery a good working over

The first time I laid eyes on the man, he was ogling my dinner date. At the moment I was seated far down the table from my inamorata, and the intervening conversations drowned out whatever suggestions he was putting to her. (The suggestions, I might add, were accompanied by enough moustache twisting to stock a repertory troupe specializing in melodrama.)

"Who," I demanded as we drove home, "was that creep and what, as if I didn't know, did he want?"

"That creep," I was told, "was your favorite artist, Saul Steinberg, and he wanted me to know that he was neither understood nor appreciated."

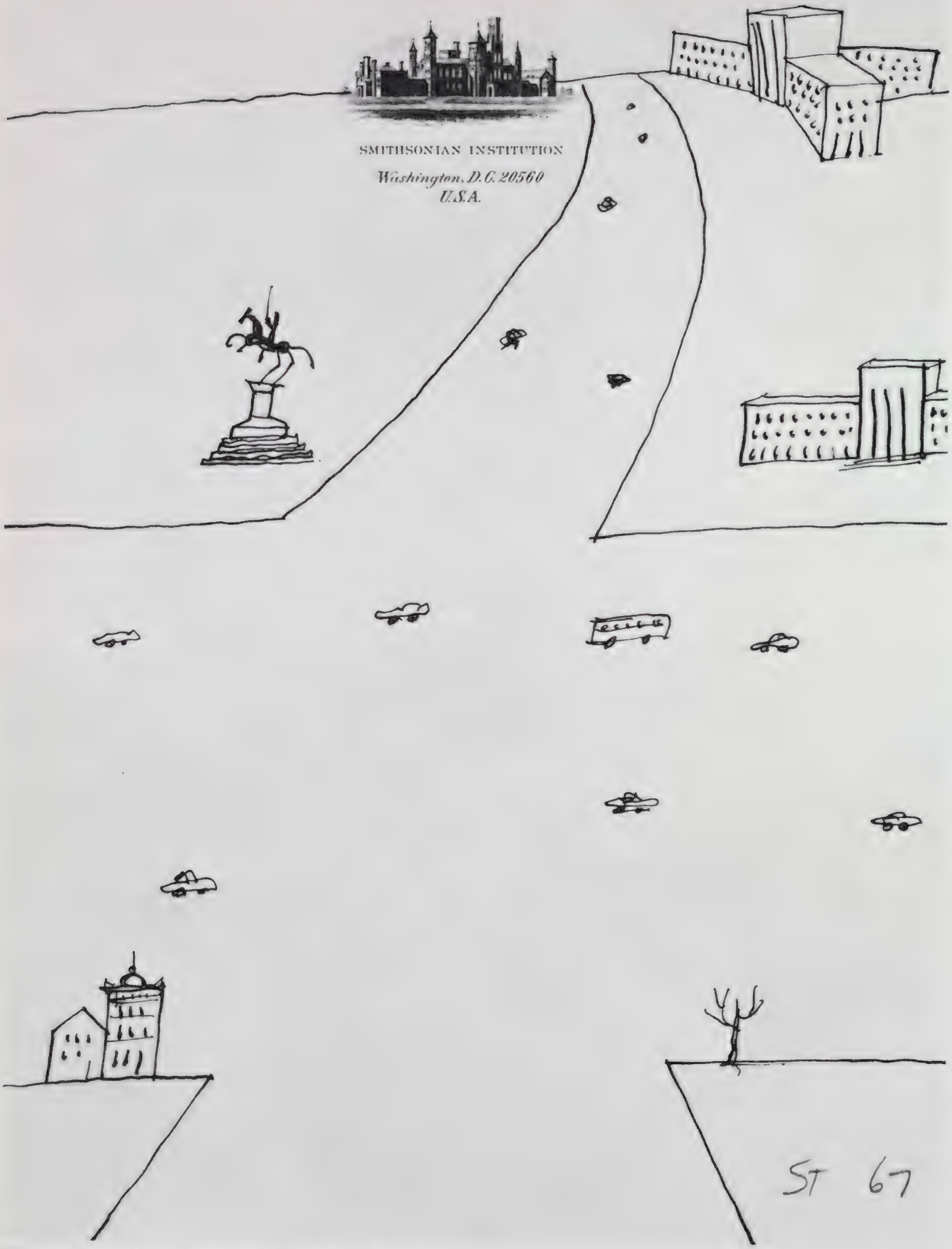
The next time I saw Steinberg was a few weeks ago, at his spacious studio in downtown Manhattan, where I had gone to interview him about 36 of his drawings, done in 1967 while he was artist-in-residence at the Smithsonian Institution and currently on exhibition at the National Collection of Fine Arts (through February 10).

Seating me with manifest reluctance at a table, Steinberg twisted his moustache, fixed me with the same lugubrious gaze he had turned on my lady friend a year earlier and informed me that neither I nor anyone else understood or appreciated his work—a bit of conviviality complemented quite nicely by the empty Burgundy bottle that stood on the table between us and bore the label: *Déjà bu*. Somewhat diffidently, I asked Steinberg about his tenure at the Smithsonian.

"The exhibition," he replied, " 'Metamorphoses of an Emblem,' is a souvenir of the three months or so I spent as artist-in-residence down there. It was a project that was supposed to have gone ahead with other artists, but now it looks as though I was the one and only. I suppose the standard I established was so high they couldn't find anyone to follow it." If there was a scintilla of facetiousness or self-mockery in the observation, it was altogether imperceptible. Steinberg continued characteristically to rest his chin heavily on the heel of his hand, twist his moustache ruminatively and gaze at some ineffably tragic inscape.

The retrospective mood was contagious. I found myself Prousting around among various Steinberg works and characteristics I had known in the past: the numerous and varied cartoons and drawings that he has produced for *The New Yorker* since 1941; the fake bureaucratic documents, covered with gibberish, that somehow had a credibility the genuine articles lacked; the extraordinary ability to render sound—anything from Scarlatti to Brahms—visually; the architectural clichés and the trite devices of monumental sculpture, mordantly recycled in outrageous juxtaposition; the ubiquitous dogs and sphinxlike cats; the brilliant, seemingly offhand parodies of major artistic styles (a

The engraving of the Smithsonian castle is reinterpreted to become the insignia on a funnel.



The castle, relocated, overlooks "frightening" architecture and a non-existent equestrian statue.

family of five, dog included, for instance, simultaneously serving as a formal portrait, a floor plan of its own home and a mini-treatise on Bauhaus design).

Steinberg, who was born in Romania in 1914, had his first drawing published in 1936. By his own admission, "The whole history of art influenced me: Egyptian paintings, latrine drawings, primitive and insane art, Seurat, children's drawings, embroidery, Paul Klee. But I also liked all sorts of disreputable things like cartoons and advertising art." He considers architecture—the "most noble, difficult and philosophical branch of the arts"—to be one of his chief influences.

"When I look back," Steinberg told me,"to my stay in Washington, in Georgetown, it is as though I had been in Norway or Tibet. I say 'Norway' because I've never been there. But I imagine Norwegians being afraid to fall out of bed and into the fjords. I think of Georgetown as a plateau surrounded by dangers.

"I went with the purpose of finding out about Washington—the plateaus, the highlands of the city and about the government. I worked there as I would work anywhere, but Washington is not a place where an artist can live. No more so than any small town, except that it is the capital of the United States and is permeated with American characteristics.

"I'd say that New York has had a great influence on American art because of the luminosity of its sky and the prevalence of paint everywhere. You have signs everywhere in a kind of no-man's-land, bandit territory, while in Washington you have just the opposite: ready-made art, bland townhouses of Georgetown, goody-goody churches, a completely American kind of city planning. The only interesting architecture in Washington is government architecture and, like bureaucratic architecture anywhere, it's one of the most frightening things to look at or be near."

Steinberg, who studied architecture in Italy during the Thirties, obviously harbors some pronounced notions of architecture's potential for good and evil.

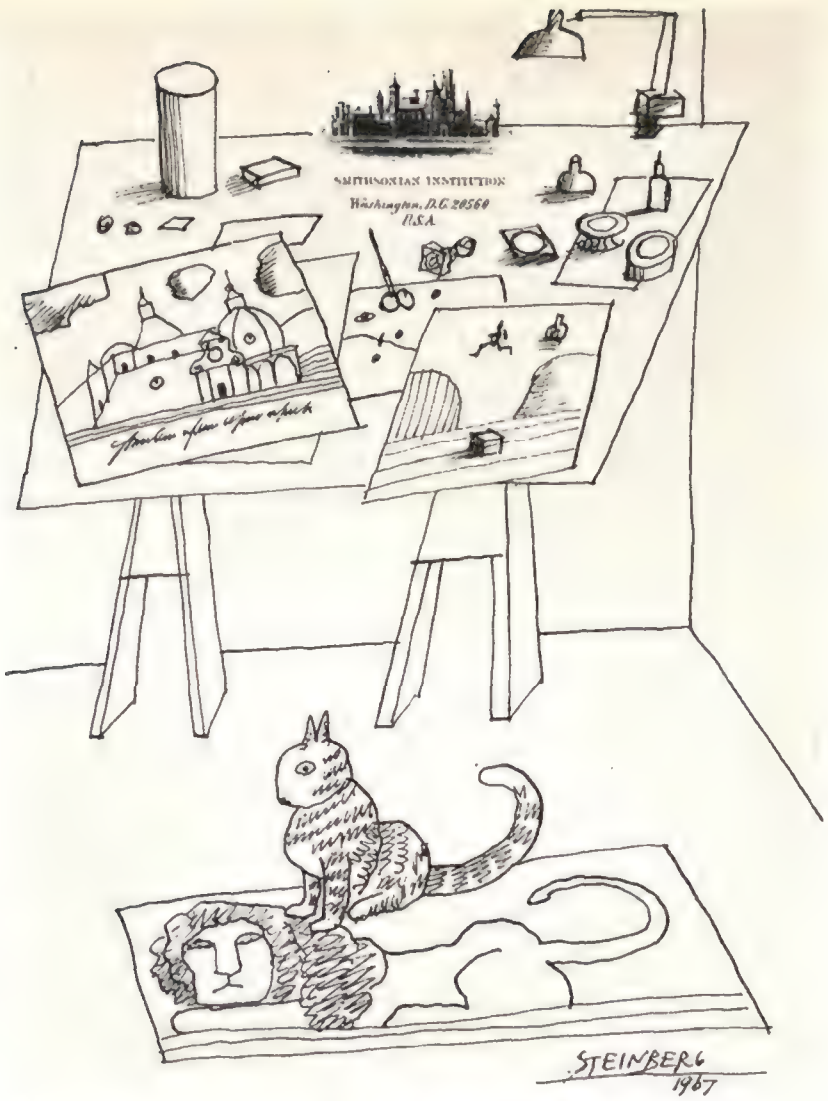
I asked Steinberg whether the Smithsonian had imposed any conditions or restrictions on his residency. "No," he replied, "there were no limitations of any kind. The only way to work is to do what you'd do anywhere. For three months I was transplanted, like a bird who beautifies the landscape with his feathers and then flies away."

The drawings on show at the National Collection of Fine Arts all were executed on Smithsonian stationery and incorporate an engraved letterhead elevation of James Renwick's original Smithsonian building. At the risk of ruffling the feathers with which he had fleetingly beautified the landscape around Washington, I

Jay Jacobs, a New York free-lance writer, is currently editor-at-large of The Art Gallery.

Can this dog be feeling wistful about the Institution or is it worried about meager parking on the Mall?

A porcelain teapot, of the type that Steinberg saw all over Georgetown, shares a still life with a cat.



The castle is perched like a paperweight atop a drafting table, cluttered with works-in-progress.

asked Steinberg whether the city or its architecture had really had no influence on the work he had done there. "Not the city itself or its architecture," he said, "but one of the real influences was its china."

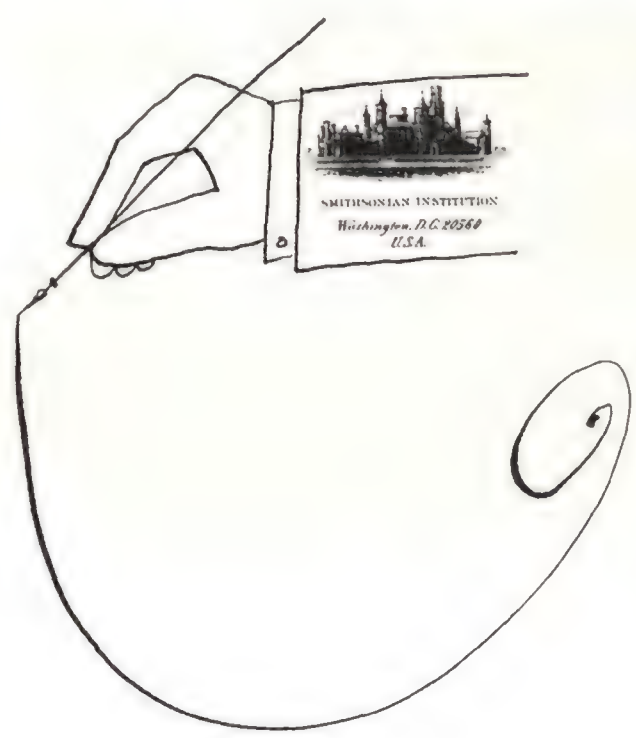
"It's *China*?" I said, unaware that Dr. Henry Kissinger had annexed the People's Republic.

"I mean its china china. There is a prevalence of teapots and such objects in Washington, things brought to the city by old China hands who temporarily were stationed in Washington. Wherever I went in Georgetown, I discovered very good china and its characteristic blue color and the quality of its landscape decorations. This, to me, was the important thing about working in Washington."

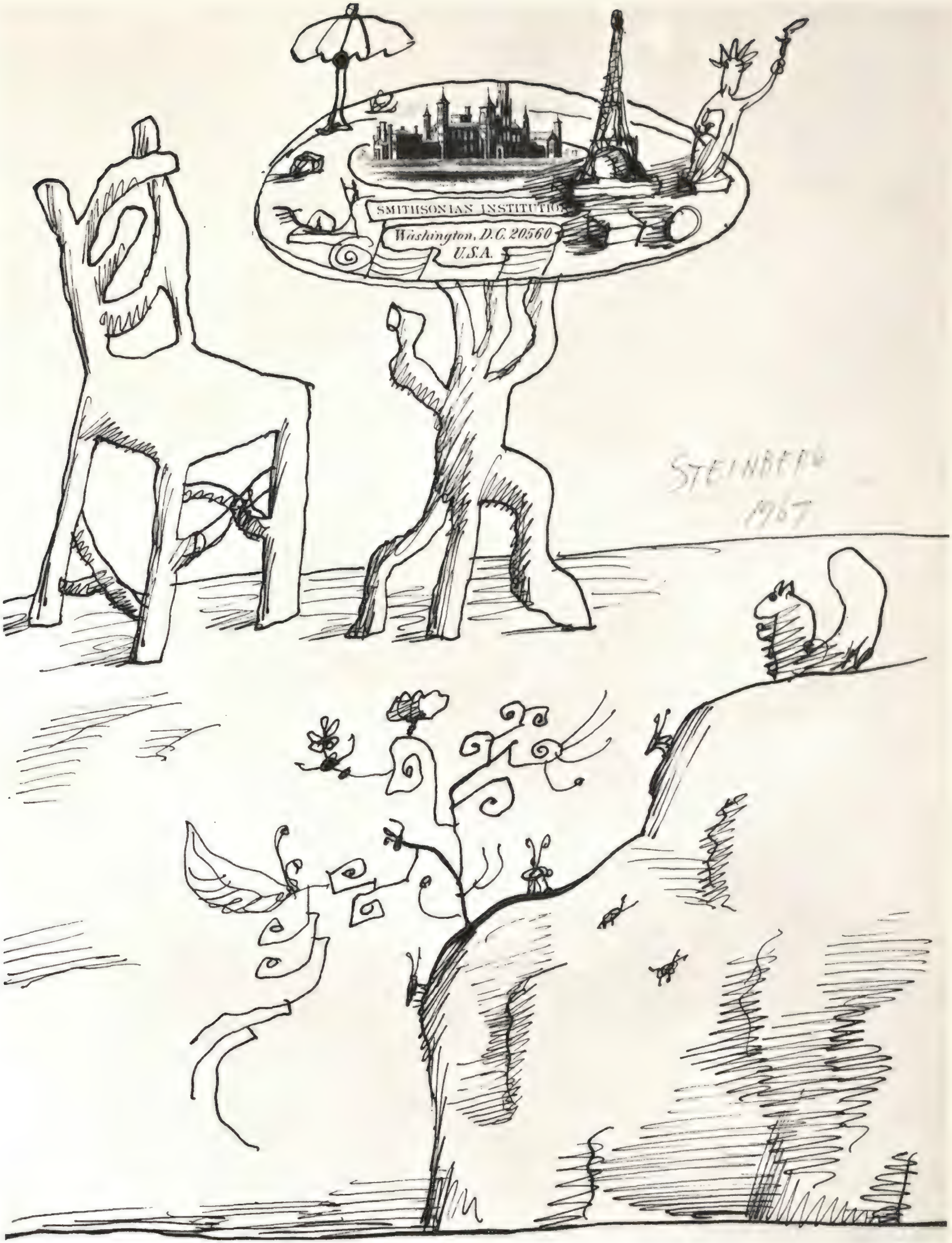
In some of the Steinberg Smithsonian drawings in the exhibition there is a direct reference to Chinese export porcelain—as in the drawing (see p. 57) in which the Renwick castle is metamorphosed into one of the printed embellishments so common on the souvenir teapots prized by our grandparents. To my mind, it and a bird's-eye view of the Mall, with the Smithsonian engraving at its far end (see pp. 56-57), are the most effective drawings in the show and I suggested, on my way out, that most readers of this article might find them more understandable than some of the others.

"The SMITHSONIAN readers," Steinberg said, "can go fishing for amberjack in Florida." At first, this sounded like a euphemism, but he went on to explain: "I once went out on one of the fishing boats they use there. When an amberjack was hooked, a button would be pushed and the fish would be brought up by means of a winch. The captain and his henchmen would then wait with baseball clubs and hit this beautiful creature over the head. It was pure assassination."

Steinberg, who clearly had yet to taste a hook, wasn't about to be hauled up on a winch. I may not understand him but his art still knocks me out.



A disembodied but thoroughly controlled hand draws an elegant flourish—off the cuff, so to speak.



In this setting, the castle is one more knickknack,
like the Eiffel Tower and Statue of Liberty.

By Susan Schlee

For many fish, schooling is the only way to go

Men have long marveled at great shoals of fish, but only now do we begin to understand why they gather that way

Schooling behavior among fish, which can bring together countless thousands of individuals to swim in such perfect synchrony that they appear to be governed by a single brain, represents a successful way of life for many different kinds of fish. Some 4,000 species of fish—both marine and freshwater—school for at least part of their lives. "Great schools" may contain so many thousands of fish as to be virtually continuous for 15 miles or more, yet a school of another kind of fish may contain less than a dozen individuals (photographs were taken in the Red Sea and the Pacific). Schooling is done by large fish and small fish, by predators and plankton-eaters, by fish of the open sea and by species living in shallow, coastal waters. Some fish school almost continuously, others only as juveniles or only at certain times of the year.

In spite of all these differences, the most notable schoolers—such as herring, anchovies, sardines, silversides, bluefish, mackerel and tuna—have several significant features in common. They live in well-lit waters, they tend to be silvery in color, they are sleek but with limited maneuverability (true schoolers can't swim backwards), and they all gather in schools containing a uniform size of fish.

Studies of fish behavior have almost always been

A school of orange fairy bass roams upward from a reef in the Red Sea off the Arabian coast.

Photographs by Douglas Faulkner

Schooling helps fish survive

motivated by the desire to catch more fish and, consequently, it is not surprising to find many of the earliest observations of fish behavior coming from countries where fishing was enormously important. In the 1700s, for example, a bishop of Bergen noted in *The Natural History of Norway* that "They [large sturgeon] do not swim together in shoals [a common term for schools] . . . but follow one another in a straight line, laying hold of each other's tails. When a whole string of them is seen together, they are sometimes taken for a great Sea-snake."

Other, even earlier, observations were concerned less with the forms of shoaling than with the great migrations—a spectacular phenomenon which they understandably combined in their minds with schooling itself. The important thing to them was that armies of fish appeared at certain times each year in tremendous flashing shoals, and these they believed were led from their feeding grounds to their spawning grounds and back again by the will of God.

One writer noted: "And God did also let the herring fishery fall away in the following year, and has since taken it from us, so that now in this year 1599 no herring has come. If this has befallen [us] for the great ungodliness of the fishermen with their strife, their blows, their evil language . . . for the loose and debauched manner of life common among them . . . it did happen that a woman gave birth to a child as she stood in a boat and packed herring, and she threw the child into the barrel, and salted it among the herring. . . ."

Such explanations of erratic migrations were common well into the 19th century, at which time it began to be argued that the forces of nature were accountable for the capricious behavior of fish. In the 1870s, for example, a Swedish chemist said that fish grouped together and migrated in response to their preference for water masses of a certain temperature and salinity. A colleague enlarged upon this and suggested that actually the fish were following certain types of plankton which grew best in these favored water masses. A third friend then offered the most purely mechanical explanation—namely that the fish did not actively swim from place to place but were passively swept from banks to fjords by the movement of huge internal waves.

This was a lively beginning, but in these studies schooling was still being treated as an adjunct of migration. For a moment it seemed as if schooling studies might come into their own when, in 1876, a British aquarium manager wondered out loud before a Society of Arts meeting why the schools of herring under his care broke up at night and reformed in the early morning. It was, at that time, suggested that the instinct to school was overcome nightly by the urge to feed. Unfortunately, no one undertook studies to answer this question and schooling was left alone for 50 years.

It was in 1927 that Albert E. Parr, a Norwegian-born zoologist, then working at the New York Aquarium, wrote a paper on the schooling behavior of fishes in which he substituted a simple balance of visual attraction and repulsion for the "social aims" which, by their very inscrutability, had for so long blocked experimental studies.

Position is everything

Parr had noticed that if two fish of schooling habits were placed in a tank they almost immediately lined up and swam in practically parallel courses. When more fish were added they gathered first in a loose group, then seemed to contract into a stable, well-defined school. What he believed was happening was that each fish was trying to strike a balance between the two fish that it could see swimming to either side of it. The fish on the outer edges of this loose group, having fish only to one side of them, were therefore out of balance and so tended to crowd inward. This unbalanced the next row of fish who crowded inward, in turn, to maintain their equidistant spacing and this wave of contraction continued until the mass of fish attained a uniform density with approximately the same distance among them as would have been found between the original two fish swimming together in the tank.

Parr's interpretations rested on the assumption that fish react to each other visually. To test this, he took a few chub mackerel out of a tank, dried their unblinking eyes, and smeared them with a mixture of vaseline and lampblack. Thus temporarily blinded, the fish rushed excitedly about, then settled down—but not to school. Even when they inadvertently swam straight through the mill, colliding with other fish, they did

Cardinalfish move through the staghorn coral of a reef in the Palau Islands of the Pacific.

Group living apparently enhances survival of blue devils, another fish found in the Red Sea.

Schooling helps fish survive

not turn and join the circling. After a quarter of an hour or more the lampblack began to wear off and as their vision was restored the fish joined the school.

Parr's paper stimulated a burst of interest in schooling, especially in the mechanism of the behavior itself. What attracted one fish to another? Color? Form? Size? Movement? Sound and smell? And what oriented each so precisely as it swam within the school?

New experiments showed that many schooling species had good vision and could see for a distance of 40 feet in clear water. It was also discovered that some fish have a degree of color vision, but others seemed to be more attracted by the swimming movement of other fish than by color, size and shape. The roles that sound, touch and smell might play in schooling were more difficult to ascertain, but it was generally agreed that their function was secondary to that of vision.

The fine details of synchronous movement were even more difficult to study, so much more, in fact, that it was postponed until well after World War II when underwater movies were used to "watch" schools maneuver. Later still it was discovered that part of the lateral line system (a network of nerves distributed over the head and along a narrow band running down the body of the fish) seems to be sensitive to near-field water movements. Such sensitivity could enable a fish to make the fine adjustments necessary for maintaining precise parallel orientation and even spacing. But these investigations belonged to the future and scientists in the 1930s expended their energies on studies that were less technologically demanding but certainly no less exciting.

Another scientist at the New York Aquarium, C. M. Breder jr., began what became a lifelong study of schooling. His early work confirmed (among many other things) that schools are leaderless except in some unusual situations—for example, when a white goldfish is a part of a normally colored school.

Such studies as these had scarcely gained a decade's momentum when World War II put a temporary halt to them. Clearly nonessential to the military effort, schooling studies were dropped, yet curiously they later derived some unexpected benefits from the new tools and techniques developed during the war. There were, for instance, greatly improved hydrophones, which during the war had been used to record the snappings, cracklings, gruntings and groanings of the shrimp and fish that had so confounded submarine crews. After the war hydrophones were also used, without great success, to try to record the sounds of schooling fish. That such patterns of sounds existed was already known to a few practical souls such as the Ghanaian fishermen who paddled out to sea in long dugout canoes and listened for herring, cavalla or shad by resting an ear on the handle end of a special paddle while slowly rotating the flattened, three-pronged blade in the water.

A greater boon to scientists interested in schooling (and to fishermen) were the echo sounders that had been immensely improved during the war. Ronald Balls, British skipper of a herring drifter, used an echo sounder for ten years and found that during the day he often received no echoes from objects between the surface and the bottom, yet in the evening, in the same place, tiny smudges appeared on his record above the constant line that represented the sea floor. A short while later he shot his fleet of nets and captured thousands of fish.

Herring feed by night

He believed that during the day the herring swam in a single layer close to the bottom to keep as far as possible from the sunlight and exposure to predators. (This was in some 30 fathoms of water.) In the evening the fish gathered into much thicker schools, which reflected the pulses from his echo sounder. They moved slowly upwards, then spread out upon the surface to feed (which the aquarium manager had noticed 75 years before). As dawn broke the fish slowly settled to the bottom, apparently in a random manner.

In understanding how schools behave, it became desirable to find out how schooling develops in the very youngest fish. Early in the 1960s, Evelyn Shaw, working at the American Museum of Natural History and at both the Marine Biological Laboratory and the Woods Hole Oceanographic Institution on Cape Cod, set out to try to find out, using two species of silver-

Susan Schlee's last SMITHSONIAN *article (November 1972) revealed how a common rock snail is able to ravage oyster beds.*

sides. In Cape Cod waters the eggs of these fish are laid in a sticky slime that adheres to rocks and the stems of marine grasses. Early in summer they hatch, and the larvae float off as part of the drifting plankton. At this stage in their lives, they were so small as to be almost invisible in their natural surroundings. Consequently, she raised a thousand eggs in her laboratory and viewed the tiny fry that hatched from them through a one-way mirror so as to alter their natural behavior as little as possible.

Silversides begin to school

When newly hatched, the fry were about a quarter-of-an-inch long, and at this age when any two fish approached each other they both darted away. When they had grown only a fraction of an inch longer, their behavior began to change. If one fry approached another from behind, it would apparently be attracted by the mild stimulus of a silvery stripe and transparent tail moving rhythmically away and would swim on a parallel course for a second or two before veering off. If, on the other hand, it met the same fish head-on, it was repelled, possibly by the much stronger stimulus of two bright eyes moving directly toward it, and would dart away. By the time the fry were two-fifths-of-an-inch long, the head-to-tail approach had become predominant and both fish would briefly vibrate their entire bodies, then swim off in tandem for up to a minute. They would sometimes be joined by three or four others and here, among these minuscule fish, was a loose, fleeting, but recognizable school.

At the same time that Evelyn Shaw was raising her silversides, work was being done on what might appear to be the simplest question—when is a group of fish a school? Albert Parr had thrown out this question in 1927 and had taken the first step in answering it by dividing fish into two groups, the occasional schoolers that are brought together by "immediate environmental factors" such as the presence of food or the approach of a predator, and secondly the almost constant or true schoolers whose behavior seems regulated more by internal factors than by external ones.

For several decades no one addressed this problem directly and, in the absence of a clear definition, a welter of confused terminology grew up around the subject. Nearly every scientist meant something slightly different by the word "school" and each used other terms such as "pod," "aggregation," "row" or "mill" to cover the groups of fish that did not fit his definition. Fishermen, too, coined their terms, often based on a school's behavior, size or whereabouts. Among West Coast tuna fishermen, for example, surface schools could be "breezers" (if the barely submerged fins caused the water to ripple) or "boilers," "foamers"

By day a formation of fusiliers glides at a depth of 55 feet through waters of the Palau Islands.

By night a fusilier of another species is caught sleeping under a coral formation.

or "meat balls" (if the fish fed so actively that they churned and beat the water).

Among fishermen such diverse terms served well enough, but among scientists the discrepancies were a source of confusion. Try as they might, their terminology could not be cleared up until descriptions such as "the school drew closer together" or "the fish swam faster" were replaced by sets of equations describing fish-to-fish spacing and calculations of fish speeds. By filming fish as they swam both over and alongside a set of grids, investigators found that fish in a school were packed together with equal spacing in all dimensions: The distances between a fish and the ones swimming to either side, ahead and behind, and under and over it, were all the same. The films also showed that diagonal or diamond-shaped patterns were favored over straight grids. A more precise definition of "school" was finally formulated—the term now generally refers to a grouping based on mutual attraction and exhibiting specific geometrical relationships.

The discovery of prevalent diamond-shaped swimming positions had a bearing on another group of questions, namely those relating to the hydrodynamics of schooling. Scientists believed that the swirls and eddies generated by swimming had a lot to do with the position a fish would favor within a school. It had been observed that as a fish wove its way through the water, oppositely rotating vortices (small whirlpools) were formed first on one side of the fish, then on the other. This created a wake that trailed off behind the fish. It seemed logical to assume that the most uncomfortable place for a second fish to swim would be directly behind the tail of another where he would be constantly buffeted by the turbulent wake. If, instead, a fish followed behind but to either side of the leader, he would have an easier swim; hence the adoption of the diamond-shaped pattern.

Recent studies went a step further, suggesting that the wakes of closely spaced fish might reduce the water resistance of those following behind, making it easier for them to swim in a school than to swim alone. (Similar work suggests that birds that fly in formation, such as Canada geese, may also benefit from the air currents created by the birds in front of them.) The extent to which these theoretical results may apply to real and less-than-perfectly spaced fish swimming in the sea is still to be determined, but the investigations suggest an additional answer for that most difficult question, "*why* do fish school?"

The most common explanation is that schooling insures adequate reproduction by gathering males and females together. This can't be the whole answer for it fails to explain why only the juveniles of some species school and why other schooling fish disband precisely at breeding time.

A second reason nearly as frequently advanced is that schooling affords protection from predators. The idea was that predators were less likely to encounter a single mass of fish than a random scattering of individuals. A similar problem—is a convoy more or less likely than unescorted ships to encounter predatory submarines in crossing an ocean—was intensely studied during World War II and a "theory of search" worked out. Applied to fish, the theory suggests that although a school is somewhat easier for a predator to spot than a single fish, the school will be encountered less frequently. Since only so many fish will be eaten at each encounter, the fish has a better chance of survival in a school than as a lone swimmer. This theory also suggests that it would also be to a predator's advantage to school, thereby broadening his field of vision or "swept path."

A "group effect" has also been given as a reason for schooling, the "effect" enabling a fish to learn more quickly and start feeding faster.

Finally, fish may conserve energy by making use of the wakes cast off within the school.

Clearly, the reasons for schooling are varied and complex and they must differ from species to species as does the behavior itself. Further investigations will untangle many of the remaining problems but even with a better understanding of the reasons why, men will always marvel on encountering "mightti Sculles . . . that sumtime . . . breke large Nettes" or the "immense multitudes of fish [that] assume the arrangement of a mighty army, with its wings stretched out parallel to the land. . . ."

Another fish found on Palau Island reefs, the opal sweeper, forms schools under ledges and in caves.

By Russ Kinne

Deep footprint (above) and cast (left, compared to human foot) suggest a 500-pound creature.

The search goes on for Bigfoot

A huge, shy primate unknown to science or a 160-year-old fraud—whatever it is, it has left tracks all over the Pacific Northwest

They saw one last summer in Illinois. It rose up in the darkness, smelling of the slime of a sluggish river, and scared some carnival ponies and several citizens of the town of Murphysboro before it disappeared.

This was one of the hundreds of sightings of hulking, hairy, manlike creatures that have been reported over the last 160 years or so, but it was a most unusual one. Most of the sightings have been in the Pacific Northwest, where the creature is known as Sasquatch. That is also where most of the footprints have been found, and where the creature was photographed on 16 millimeter motion-picture film. At least maybe it was photographed.

Most human societies harbor a deep-seated myth about such a creature—what child hasn't at one time or another worried about the bogeyman? But some people think a bogeyman of sorts exists. The Abominable Snowman of the Himalayas—also known as Yeti—is perhaps the best known candidate. The Indian tribes of America's West Coast had a variety of names for the American Sasquatch (a Salish name). Yet another name for it is Bigfoot and it is apt: The deeply imprinted footprints attributed to Sasquatch are some 4 to 7 inches wide and from 12 to 17 inches long—clearly the spoor of an enormous animal, or of an extraordinarily industrious footprint hoaxer.

Can it be that in the Space Age there is a huge living primate about which science knows nothing? And one that lives in our own country to boot? I recall discussing it with a widely known nature editor in New York who laughingly informed me that the entire idea was preposterous, that a Sasquatch couldn't possibly remain hidden in this day and age when the woods are crawling with hunters, campers and snowmobilers. Shortly thereafter I was flying down through the river valleys of northern California and the thought crossed my mind that you could hide a herd of elephants in any square mile of that country with no trouble at all. In California alone the northern wilderness is about the size of the state of Maine. There is plenty of room for Sasquatch, and plenty of food and water.

But *do* Sasquatches exist? Opinions are plentiful, evidence is in limited supply and there is currently no

A widely known free-lance photographer and film maker, Russ Kinne specializes in nature subjects.

proof one way or the other. Most scientifically trained people who think about it at all believe it is all nonsense, but a few scientists believe in Sasquatch. And so does Peter Byrne, an animal-tracker of legendary skill, who is currently camped out in The Dalles, Oregon, determined, once and for all, to prove Sasquatch's existence or lack of it.

Byrne is a 47-year-old, Irish-born former big-game hunter who at one time specialized in taking U.S. sportsmen on tiger hunts in Nepal on the edge of the Himalayas. Recognizing that the tiger was in serious trouble, he established a 50,000-acre tiger sanctuary and helped found the International Wildlife Conservation Society in Washington, D.C., which administers it. While in Nepal, Byrne had undertaken several major Yeti-hunting expeditions and then became interested in the American Sasquatch. Using his own resources and aided by a few small contributions, Byrne has been tracking Sasquatch for 35 months, collecting all the available sighting reports, following every lead, every footprint.

Sasquatch first appears in white man's records in 1811 when an exploring party led by David Thompson found 14-inch by 8-inch footprints in Canada that seemed too large to be those of a bear. The Indian guides, though armed with guns, would not hear of pursuing these tracks. Over the years, as the wild areas of the Northwest were settled, there were many other reports of tracks and of meetings between Sasquatches and humans.

In 1884, a construction crew was building the railroad near Yale, British Columbia, when the train engineer came upon a "gorilla-type" creature lying asleep or unconscious near the roadbed. Awakened, apparently, by the sound of the train stopping, it began to climb the bluff with the train crew in hot pursuit. It was eventually cornered, felled by a rock dropped on its head from above, and held captive for several days in Yale. From the description—more than four feet tall and covered with hair and of "extraordinary strength"—it could have been an ape or a small or young Sasquatch. But captive apes were rare in the United States and Canada. The fate of Jacko, as the creature was named, is unknown because the local newspaper was being relocated at the time and subsequent issues carried no further mention of the creature.

There are literally hundreds of reports in newspaper files in which one or more people have seen one or more of these creatures. Their descriptions, unlike those of UFOs, are almost always about the same. The creatures stand about eight feet tall, have no neck and are covered with short hair—reddish brown, and sometimes black below the knee. They have been likened to a long-legged gorilla and walk upright in a flatfooted gait. (Bears drop on all fours when moving.)

In March 1973, four fishermen saw a Sasquatch emerge from the forest, walk along a beach and reenter the woods. Most contacts have been similar, though the number of eyewitnesses range from one to a dozen people. The Sasquatch may be seen for just a few seconds as it crosses a road or it may stay in sight for several minutes.

A 500-pound footprint machine?

Now it would be fairly easy to dismiss all of this as mass hallucination except for several things. First, the reports, though separated by hundreds of miles and scores of years, do tend to match. Furthermore, eyewitnesses do not necessarily tend to come forward readily; instead, most are reluctant to talk about their sightings and many have insisted on anonymity—hardly the actions of publicity-seekers. No one, it seems, likes to be laughed at, so eyewitnesses keep quiet and must be sought out. So far Peter Byrne has interviewed more than 70 in his quest for Bigfoot. And he has followed Bigfoot's tracks.

Mass hysteria cannot explain the footprints. Thousands have been examined, hundreds cast in plaster. Can they be brushed aside as fakes? Peter Byrne once followed such tracks for 7 miles along a snowy mountain ridge, some 11 miles in the woods. "This alone would make a believer out of anyone," says Byrne.

Indeed, did someone really transport a 500-pound footprint-making machine back in there—one that could walk on two "legs" without supporting legs that would have left their own tracks in the snow? And all this where a hoaxer could not expect Byrne or anyone else to see them before they melted?

Dr. Grover Krantz of Washington State University at Pullman is one of the few scientists who believes that Sasquatch may exist. He has examined dozens of

Former tiger-tracker Peter Byrne stalks the Pacific Northwest, confident that he will find Bigfoot.

casts of the footprints and sees significant differences between them and human feet. He has drawn the probable bone structure on the casts themselves (see page 68) and finds certain formations that would be essential for a 500- to 800-pound animal. If these prints were faked, he claims, they must have been faked by an expert in anatomy.

The footprints are hard to explain away, yet they do not comprise what scientists would call hard evidence. Patches of hair and droppings found in the woods have been examined at the Smithsonian Institution: The material was found to be bearlike but some was unidentifiable. One would think a photograph would be all that is needed to conclude that Sasquatch is real but that, too, is not enough.

Some years ago, a California rancher named Roger Patterson became interested in Sasquatch and began searching in earnest. Four years later, in 1967, he exposed about 25 seconds of extraordinary and very controversial movie film. What money he made from this was spent on an additional four-year search, at the end of which he died a natural death. The Patterson film has been shown to a number of scientific groups, and has been most carefully examined in every detail. It is unfortunately of very poor quality, taken with a cheap 16-millimeter camera at a distance of more than 100 feet. Worse, Patterson was not sure whether the camera was set at 16 frames per second (fps) or at 24.

A man in a fur suit?

The film shows an upright creature—small for a Sasquatch, about seven feet tall—which walks across the field of view, turns to look toward the camera, and continues on out of sight (see p. 72). It left fairly small footprints, about 14½ inches long, which would be roughly commensurate with its height, though there is disagreement about this among anatomists.

It is not just scientists who have examined the film, however. What is probably the world's best and most famous animation studio examined it carefully, and declared they thought it was a living animal, *not* a man in a fur suit. In fact, they said that the only firm in the world capable of faking such a creature successfully was their own studio—and they hadn't done it.

In London, Dr. Donald W. Grieve, an anatomist specializing in the human gait at the Royal Free Hospital School of Medicine, analyzed the film frame by frame and made detailed studies of factors such as angular leg movements, stride length and time of leg swing. He concluded that if the framing speed were 16 or 18 fps, fakery is unlikely but at 24 fps, it could be "a very clever fake." Dr. Grieve has written that his impressions "oscillated between total acceptance of the Sasquatch to irrational rejection based on an emotional response to the possibility that the Sasquatch actually exists."

More recently, Dr. Dmitri D. Donsky, Chief of Biomechanics at the USSR Central Institute of Physical Culture in Moscow, has studied the film. Like Dr. Grieve, he has made exhaustive measurements of all parts of the gait, and also the torso-swing when the creature turns toward the camera. He says that the walk as demonstrated by the creature in the film "is absolutely nontypical of man," and that he does not believe the film was faked.

The evidence of the film is less impressive to a distinguished British physical anthropologist, Dr. John Napier, formerly of the Smithsonian Institution. In a recently released book, *Bigfoot: The Yeti and Sasquatch in Myth and Reality,* he concludes that the Yeti or Abominable Snowman of the Himalayas is surely a myth. As for Sasquatch, the Patterson film, he says, is inconclusive. Even given the capacity which

most humans have of deluding themselves, Napier finds the many eyewitness reports persuasive and the footprints conclusive. "Either some of the footprints are real, or all are fakes," he writes, and the latter seems to him to be impossible. "I am convinced that the Sasquatch exists," he goes on, "but whether it is all that it is cracked up to be is another matter altogether."

If Sasquatch exists, then what is it? Napier suggests that the best candidate for the ancestors of Sasquatch is *Paranthropus*, an evolutionary offshoot in the course of human evolution, an apelike vegetarian that lived some two million years ago according to fossils found in Africa. As Napier points out, if Sasquatch does turn out to exist, the zoologists and anthropologists will have a great deal to explain.

For now, the best hope of settling the question of Sasquatch's existence is Peter Byrne. No scientific group has ever undertaken a serious search of any magnitude, nor does it seem likely that any will soon. There is a considerable number of "weekend warriors" who go forth heavily armed to seek the Sasquatch in the name of sport. Of the handful of serious searchers, many also believe in killing the first one they see. Canadian John Green, for example, has said, "Gun it down, cut off a piece you can carry and get out of there."

Peter Byrne considers this approach inhumane as well as unnecessary—especially because the Sasquatch, if it exists at all, is a rare species that furthermore might prove to be subhuman. Byrne carries a tranquilizer gun with him as he stalks the wilderness and plans to immobilize his prey long enough for a group of scientists to arrive and examine and photograph it. (Since its existence has not been shown in an approved manner, the Sasquatch does not enjoy the protection of other rare and endangered species—except in Skamania County in Washington where an ordinance was passed in 1969 prohibiting the wanton slaying of "a nocturnal primate—described as an apelike creature, or a subspecies of Homo sapiens.")

For now Byrne operates out of his headquarters at The Dalles, Oregon, following up every lead that comes along. He has built an observatory overlooking an area where Sasquatches have reportedly been seen regularly—in seven out of nine successive years. He is often asked why, if Sasquatches exist and are so large, they are so seldom seen. One could draw a parallel to the cougar which certainly does exist in the Pacific Northwest but is shy, wary, alert and avoids humans quite successfully. Many people have lived 40 years in remote areas without ever seeing one.

Says Byrne, "There are perhaps only one or two hundred Sasquatches, spread over an area of thousands of square miles; you can see that the population density is very low at best. Then consider that you must also have a human at the same time and place to do the sighting and you begin to see the problem. And the Sasquatch is basically very shy and has far sharper senses than Man's; he can easily avoid human contact. As if this weren't enough, whenever a Sasquatch *does* show his face, likely as not someone tries to kill him with a gun. Can you blame them for avoiding humans?"

Bigfoot in motion or an elaborate hoax: Scientists disagree about the film from which this still was made.

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S1-74

The twins at left were acquired by the author in Nigeria. They and the others on these four pages were photographed by the late Eliot Elisofon. Each pair is different. To the practiced eye, such things as

By Glenn M. Loney

An African cult of lucky twins

Among the Yoruba of Nigeria, twins are favorites of the gods; when they die, images are cherished to bring their spirits back

On a long ledge running above the doorway between the living and dining rooms stood an equally long rank of black, silent, strangely staring figures. Mystifying figures—were they cult carvings? The mere fact of a handful of Nigerian wooden god-images in the home of a European resident of Lagos was, of course, nothing unusual. Such figurines make very attractive collector's items for whites who are stationed or employed in Nigeria.

But what arrested my attention immediately was the fact that the statuettes over the doorway all came in pairs. They were, in short, all twins. In most cases the pairs were male and female, although some were of the same sex. My host that evening was clearly very proud of the collection, but even he was not at all sure which set of twins was very old and which might have been recently carved for the benefit of white souvenir hunters.

"One thing's certain," he said. "I'll never be able to take all of the twins out of Nigeria when I leave. Oh, those that are fakes—those they won't care about. But I'm sure some of these must be old, and they quite

coiffures, facial scarifications, jewelry and details of costume indicate the Yoruba group to which they belong. Because frequently there is not enough food for two babies, one or both is likely to die.

understandably don't want all of Nigeria's valuable art antiquities to vanish. If you want to take anything home with you that you think might be a real find, you must take it down to the Nigerian National Museum here in Lagos and get permission from them."

After that evening, everywhere I went in Nigeria's capital city I saw sets of twins. But those that could be easily bought from street vendors or craft shops were often of raw, newly carved wood, awkwardly and rapidly aged.

Then, one night before a dinner, a trader buzzed at the door, and the guests rallied round his wares, spread out on the floor from the neat attaché case in which he carried them. He had a pair of twins (above left), strange ones. Their hair, which still bore traces of blue coloring, was intricately braided to form a kind of crest running from front to back of the heads. One twin was a boy, the other a girl. The sexual characteristics were very pronounced. The features seemed worn smooth from much handling.

"How much for these?" I asked. They were a bit over $10, and the trader would not consider bargaining. "They are very old," he said. Knowing nothing about signs and marks of age in Nigerian woodcarvings, I took his word, although several people said "They're probably fakes."

The next day I took my twins to the National Museum compound in Lagos to ask the director, Ekpo Eyo, if they were genuine. And, if so, would I be allowed to take them back to America with me? Dr. Eyo, a busy, concerned museum manager, took time out to inspect the twins. Where had I obtained them? I told him, and he noted that traders often come by their merchandise by looting it from religious shrines, by stealing it from other collectors or by smuggling it across the border.

Dr. Eyo shook his head, thinking of all this traffic in antiques which was virtually impossible to regulate or restrain. What really pained him, both as a Nigerian and as a museum director, he said, was that on a

Glenn M. Loney, a theater professor at the City University of New York in Brooklyn, wrote on Shakespeare festivals for SMITHSONIAN *(May 1972).*

recent trip to Los Angeles and the East Coast—not to mention his ramblings in London—he had seen a number of major Nigerian antiquities on display. Even though nothing of value or age can be exported without a license from the museum—and though luggage is searched on leaving Nigeria as well as on entry—valuable objects continue to flow out.

For that reason, my twins would have to be photographed and recorded, and then compared with more than 2,000 sets of twins in the storage rooms of the museum. If they were not unique, then I *might* be permitted to take them along. If they were, as I feared, very special, they'd have to stay in Nigeria and I might be given in their stead another set of twins which were duplicated in the collection.

I'd heard a number of tales about the twins and what they were supposed to mean to the Yoruba, but I thought it better to have an explanation from an expert. I asked Dr. Eyo about them.

"The twins? The *ere ibeji*?" He wrinkled his brow. "I think there was a time in the history of the Yoruba people when twins were put to death. People thought there was something unnatural about them. Then came a time when they were supposed to bring good fortune to the parents. A sign of favor from the gods, perhaps. I can't say exactly when that change took place. But, from that time to this, if a mother had twins and one of them happened to die, a small figure like this"—Dr. Eyo picked up one of my twins—"would be carved to represent the dead twin. If both twins died, then two figures were carved, just as with this pair. The twins were worshiped, because they are supposed to bring good fortune."

Dr. Eyo smiled, recalling an instance which may have proved that to be true. "About two years ago, two boys—twins—were on the way to school here in Lagos. They found an artifact in a drainage ditch. It had been uncovered by the rain. They brought it to the museum, and we gave them £5 for it. To wake up in the morning with no expectations and then, suddenly, to have £5—well, their father attributed this to the good luck twins are said to bring."

I had been told that it was believed that the death of one or both twins was often regarded as a terrible calamity. That meant that the godlike spirit or spirits which had so recently inhabited the young human bodies had plainly decided to return to the heavens, possibly because they didn't like the family or the village. Caring for and adoring the twin figures, it was thought, would show these spirits that they had been

Two sets of twins, not quadruplets—although now and then one comes across images of triplets.

Opposite: Twin images are washed, dressed and cared for, as is this pair in its beaded shrine.

mistaken to depart so abruptly. And then, perhaps, one day the spirits would again consent to be born into that bereaved family, restoring good fortune.

The Nigerian Museum is an attractive building, laid out around a central sunny courtyard, with display cases set into the walls along the open walkways. Inside, in a series of well-designed exhibit rooms, are more fragile finds. But, handsome and interesting as all this is, it is not nearly large enough to show the range of the museum's collections or to facilitate the programs in Nigerian arts and crafts offered to the public. If the treasures on display are indicative, those in storage must be well worth expanding the museum for. That, of course, takes money.

Dr. Eyo's staff in Lagos is professionally trained. They are sent out into the field to buy antiquities where possible. "But," he says, "where an artifact is part of a cult, or is in a person's possession, then we have to be content with photographing it, recording it. I've been disturbed in recent years that robbers have been stealing objects still in use in shrines. That is abominable. You see, taking such cult objects can cause someone to die. If people really believe—as many still do—that the disappearance of the image of a god means he is angry with them and does not wish to dwell among them anymore, it can have serious psychological consequences. They don't blame the god for leaving them, they blame themselves."

This situation was dramatized recently when the Afo-A-Kom, a statue sacred to the Kom people of Cameroon, turned up in the possession of a New York art dealer. That it has been returned to the Fon of Kom, through the good offices of a number of people, among them Warren Robbins of the Museum of African Art in Washington, is one small sign of changing attitudes.

As things turned out, my twins were both old and rare. But, as they were covered with dust and cobwebs, they had clearly not served as ritual images for a long time, and so no one was being deprived. Dr. Eyo kindly permitted me to keep these earthly models of a pair of heavenly twins. As he did so, he stressed that it was because he believed that I really had acquired them not for profitable resale, but so that I might have a very special memory of Nigeria and the Yoruba people every time I look at them.

And, as I write this now, I am studying them with fondness, remembering an all too short but thoroughly fascinating introduction to the rich culture of Nigeria, and hoping they will bring me luck, too, as they once did to their forlorn and bereaved parents long ago.

By Jack E. Hope

Hunters: useful pruners of nature or just killers?

Some say hunting is a moral outrage; others see it as crucial to wildlife conservation. A former hunter believes both miss the point

The object of hunting is to kill something. While a rifleman or shotgunner may have additional motives, while he may deeply, honestly appreciate the sights and sounds of the outdoors—including those of his prey—he carries a weapon for the purpose of bringing home a trophy or a meal, which means killing.

The primacy of the kill, however, does not demonstrate that hunting is evil or that it is singularly destructive of the natural community. While an abundance of evidence can be cited to condemn hunting, the least convincing of it is the fact of the kill.

As a former hunter, I recall the nature of debates between hunters and antihunters—curious, dissatisfying affairs, characterized by great leaps in logic, by easy stereotypes and rationalizations. The issues germane to the morality of hunting are complex; no code of ethics—not even the Schweitzerian "reverence for life"—can be readily and consistently applied to the widely varying circumstances under which men extinguish the lives of lower animals. (Even Schweitzer reports that he used a rifle to shoot snakes and predatory birds, an action that would be condemned by some modern ecologists.) Yet in the debates over hunting, the hunter seeks to reduce this complexity to a simple belief that hunting is "good," and his opponent chooses to believe that it is "bad."

The act of killing forms the core of antihunting sentiment, and the argument of the antihunter—essentially "how can you kill?"—makes frequent returns to this dramatic reference point. The nonhunter, who does not participate directly in death-dealing acts, cannot fathom the hunter who does. He sees the hunter as being cast in a different psychic mold from himself—lacking compassion for the welfare of the animals he pursues and for the natural world in general, seduced by a cruel passion for killing.

Within recent years, antihunting sentiment in America has grown rapidly, assisted by television broadcasts and magazine articles and by the publicity of preservation organizations that assign the nation's hunters to a relatively slim interval along the spectrum of human personality, ranging from the "army of physical slobs" to "miserable cowards with a lust to kill." One outspoken antihunting group—Friends of Animals, Inc., located in New York City—recently recommended that deer hunters garb themselves in "fawn color" and turn their rifles upon one another. Understandably, the hunter resents being cast, alone, in the bloodlust stereotype, particularly when his antagonists' bloodlust lies so apparently near the surface.

But there is little reason to believe that hunters are motivated by abnormal cruelty or propensity to violence. If this were the case, I suspect that the hunter would not confine his attention to animals designated as legal game, but would indiscriminately open fire on robins, blue jays or any other living creature that crossed his path. Some of this does occur, but the incidence is low. In my experience, hunters are over-

Drawings by Ken Rinciari

whelmingly, almost prissily, law-abiding. They are quick to censure any of their fellows who are "game hogs" or who kill "out of season" or "over the limit." They have a strong—if somewhat defensive—set of hunting ethics, the rigor of which is suggested by the wording of one well-known hunters' code: "The game-law violator is a thief." In fact, pressure from hunters and hunting organizations was instrumental in establishing the nation's early prohibitions against the year-round shooting of wild animals and in creating a funding mechanism (via hunting licenses and taxes paid on ammunition) for improving the habitat of several declining wildlife species. Until the recent upswing in environmental interest, the hunter was foremost among those few people who devoted any thought or effort to the welfare of wildlife.

Rather than excessive bloodlust, what little data we have indicate that sociological factors—place of residence, primarily—are dominant in determining whether or not a man will become a hunter. A disproportionately large number of hunters either come from or currently reside in rural settings where hunting is, simply, physically available.

And where hunting is physically available, it is more socially acceptable. In thousands of rural communities in the United States and Canada, many families consider the annual moose (or elk or deer) an important supplement to the food supply. While I have never met anyone who would have gone hungry for want of wild game, I have met dozens for whom a 150-pound white-tailed deer represented more than a week's salary or for whom an 800-pound moose provided half the family's winter meat. In the same towns, hunting has traditionally served as one of the most accessible forms of recreation.

In my own case (I grew up in a small town 100 miles north of New York City), I owned a rifle and hunted for deer before I owned a basketball or tennis racket or a pair of skis, and before I saw my first museum or ballet or professional baseball game.

Similarly, for a ruralite who has witnessed or participated in the autumn home slaughter of beef, sheep or hogs, the shooting of a deer—perhaps with the same rifle—does not represent the abhorrent spectacle that it does for the person without similar experience. In this sense, the hunter undoubtedly has a keener awareness of the biology of survival, of the necessary interdependence of life and death, than does the nonhunter. The majority of our population maintains a considerable distance, perhaps a conscience-saving distance, from the chain of events that annually fills an American stomach with 190 pounds of meat.

For the hunter, however, the necessary slaughter of lower animals is not an abstraction. In the course of the hunting process, he sees his prey alive and dead within the period of a few seconds. He opens its belly with a hunting knife, cuts loose the heart and liver, turns the animal over and dumps its intestines on the ground, wipes the blood out of the chest cavity, and drags the animal out of the forest. He sees the half-digested vegetation in the paunch and witnesses the hole through the lungs opened by his bullet. Whatever else one may say about the individual who voluntarily participates in this process, he has an indelible impression of the death he causes and of the flow of energy from plant to animal to man.

I do not mean to imply that shooting an elk is the ethical equivalent of buying a side of beef. Elk are wild and relatively rare. Cattle are domestic and plentiful. Elk are an element of diversity, a link in a naturally established chain of life. Cattle are virtually man-made, a product of the assembly line. It is biologically incorrect to assume, however, that one's decision to consume beef instead of elk, pork instead of moose, is a decision that consistently favors the welfare of wild animals. Our herds of domestic livestock compete directly (in the case of range animals such as cattle and sheep) or indirectly (in the case of penned animals whose food is cultivated elsewhere) with wildlife for

An editor and observer of environmental affairs, Mr. Hope wrote about the White Cloud mountain controversy in Idaho for SMITHSONIAN *in 1971.*

space and food. In addition, livestock ranchers engage in extensive programs of trapping and shooting those predator species which occasionally kill domestic sheep and cattle.

Perhaps only a vegetarian can lay claim to consistent, ethical behavior toward the creatures with which we share the planet. But even a well-intentioned vegetarian—nibbling romaine and supporting his trousers with a strand of hemp—can easily go astray if he lacks insight into the innumerable ways in which his daily actions bear upon the welfare of lower animals. Diminished wildlife populations in America are overwhelmingly a result of habitat destruction.

Human appetite, not only for lamb and beef, but for second homes, automobiles, paper plates, lawn furniture and kilowatt hours, has sufficiently altered the complexion of the landscape so that many wildlife populations have been pushed back into those remote or protected areas of wilderness where their specific needs for food, space and cover are met. Some species—notably the white-tailed deer, which can become a pest and fares better in brushy farmland than in wilderness—have increased in response to the mass alteration of the natural landscape, but most (especially such wilderness animals as bears, wolves, mountain lions, lynx, bobcats, wolverines, moose, elk, eagles and other large birds of prey) have declined significantly.

Due to the visibility of its impact, hunting has become something of a scapegoat among the many human activities that destroy wild animals. But the impact of resource consumption and its consequent habitat destruction is far more powerful and, unlike most hunting, results in permanent losses of wildlife. A deer herd, reduced by 10 to 20 percent during the fall hunting season, will reproduce most of its lost numbers within a one-year period, provided its food and cover remain intact. But the same herd will perish if its habitat is destroyed by a highway or mine, a reservoir or ski resort.

At first glance, this situation seems to provide a biologically and ethically sound rationale for hunting: When animals are displaced by habitat destruction, they constitute a surplus population; society thus has the choice of permitting these animals to die of starvation or of permitting hunters to shoot them, thus keeping wildlife in balance with its food and shelter.

This rationale has been adopted as the stock defense of the sport by the hunting establishment—which is made up not only of hunters but, more importantly, of state fish and game departments, the hunting media, munitions manufacturers and others who derive their income from hunting. State wildlife managers have compiled reams of data supporting hunting as a "scientific tool of wildlife management," and this is fed to the nation's hunters through the pages of popular hunting journals, as are claims that "like any growing crop, game must be harvested, or it will choke itself out of existence." Thus armed against any challenge, the hunter can enter the autumn woodlands as an ecological savior, prepared to weed out the pastures of nature. But the polemic of "scientific wildlife manage-

Hunters have a direct impression of death and of the flow of energy from plant to animal to man.

Cattle are domestic, plentiful and virtually man-made products of the assembly line.

ment" is faulty. Its conspicuous flaw is simply that hunters participate equally with nonhunters in the frivolous resource consumption that reduces wildlife habitat. Some of this consumption—the use of automobiles, helicopters, snowmobiles—is even incorporated directly into the hunting process. It is neither morally nor philosophically consistent to spend five days of each week whittling away at wildlife's living space and then to claim that the weekend hunt—the harvest of surpluses—is an act of environmental mercy.

Even in the unusual case of the white-tailed deer, which now exists in far greater numbers than in the 18th century, the concept of the hunter's harvest has only a contrived and short-term validity. Admittedly, in states such as New York and Pennsylvania, where deer populations exceed the carrying capacity of their winter habitat, the immediate results of an abolition of hunting would be dramatic: Natural deer food (mostly buds and young shoots) would be overbrowsed and unprotected farmers' crops would be damaged by foraging animals; thousands of winter-weakened deer would starve and would be killed by packs of dogs (by dogs, since other predators have been removed).

But within a period of several years, the deer population would stabilize at a new and lower level in balance with available food. And this balance would probably be a genetically healthier one than that now maintained by hunting; the natural (or approximately natural) thinning of the herd would enable the strongest animals to survive, whereas hunting indiscriminately culls weak and strong animals alike. Finally, with the reduction in deer numbers, habitat changes would occur (due to reduced browsing) and other wildlife species, though not necessarily huntable species, could then increase to occupy a portion of the space now occupied by deer.

This last change is most revealing, for it illustrates the wildlife managers' willingness to manipulate the environment to favor game animals (roughly 30 species out of the more than 1,000 species of North American wildlife), even though the manipulations inevitably create biological imbalances that work against other animal species. In the case of New York's white-tailed deer, the management now accomplished through hunting does not permit the herd to fluctuate with changes in habitat, but maintains it at an unnaturally high level during spring and summer months, then cuts it back with bullets in the fall. This helps to sell $3 million worth of hunting licenses and delights upstate chambers of commerce, but it distorts the succession and species composition of the state's plant and animal life. There is no reason for New York to have a herd of 350,000 white-tailed deer, other than to accommodate the perceived needs of hunters.

In addition to the environmental manipulation accomplished through hunting itself, most fish and game departments engage more or less actively in programs that directly alter wildlife habitat. In pamphlets handed out each fall at "deer checking" stations, New York's Department of Environmental Conservation has urged hunters to consume more firewood and other hardwood products since cutting mature forest trees results in new brushy growth that white-tailed deer feed upon. Other states actually provide funds for cutting forest growth to provide more food for the popular white-tail. In general, the hunting movement's brand of scientific management appears to be

It might seem that a deer would be better off turning into an endangered species like a cougar.

shaped more by a zeal for shooting than by an adherence to science.

In California, where about 2,400 mountain lions remain and where the lion's traditional prey species (deer and smaller mammals) are abundant, the state's Fish and Game Commission bitterly opposed a 1972 law that placed a four-year moratorium on mountain lion hunting. *Outdoor Life* magazine, one of the nation's largest hunting journals, reacted to the passage of this moratorium by lamenting that "again, scientific management of a game animal was effectively blocked." (Lion chasing, by the way, was not blocked; the state still permits the pursuit of lions with dog packs.) Hunters have traditionally perceived a competitive threat from predators. One likes to believe that our awareness of predators' scarcity and of their important biological role has made our attitudes more sophisticated than those of earlier times. But today, where predators exist in significant numbers, they are still generally despised and are often referred to collectively as "varmints." Many states still offer a bounty payment on foxes, coyotes, bobcats and lynx, or provide a year-round open season on hunting for these animals and other "undesirable" species.

In Quebec, the province's Department of Tourism, Fish and Game in 1972 announced a plan to encourage hunters to shoot more wolves, a move recommended by wildlife biologists to improve moose and deer hunting. The plan, at the time, included a unique inducement: The first 50 hunters to turn in a wolf carcass would be awarded the animal's jaws, mounted in a plastic block, with the hunter's name inscribed on it. This scheme has now been abandoned.

The social contest

The real immorality of the hunting movement is not its willingness to kill, *per se*, but its unwillingness to respect the biological and esthetic integrity of the natural world. In its selective, self-serving attitudes toward wildlife, in its eagerness to manipulate the environment for the sole sake of its sport, the hunting movement displays an ultimate insensitivity to all lower life forms; it exemplifies the belief that the only legitimate function of our planet and its organic community is to satisfy the wishes of mankind, no matter what form these wishes may take. This is the same inglorious ethic that guides the conscience of a strip miner or real estate speculator.

Among hunters this attitude is, I think, the inevitable consequence of the sport's growth and collectivization. A silent, stalking rifleman participates in a basic encounter with his environment and, in his role as killer, acquires a sensitivity to the animal he pursues—its sounds, its appearance, its daily routine, its exceptional capacity for survival, its inevitable death—that the nonhunter will never possess. A nation of hunters, competing with one another for a limited supply of game, participates in a mad, social contest, with all its inherent opportunities for vanity and frivolity—the deer on the fender, the $3,000 Alaskan hunting trip. A movement of hunters, seeking to perpetuate itself and to unite its members against a common enemy (antihunters), rationalizes its behavior and blinds itself to its own environmental sins.

Any biological ethic that seeks to harmonize our species' activities with its surroundings must be based upon some criterion of necessity. Such an ethic would surely condemn organized sport hunting, especially the wildlife managers and media that mold its opinions. But the same ethic, if it were consistent, would also condemn such things as ski resorts, 300-horsepower automobiles, swimming pools, fur coats, overeating, large families, golf courses and summer homes, and that would, of course, be very difficult to enforce, even in these days of awareness of the energy crisis.

To harmonize Man and nature calls for an ethic which hunters and antihunters would both dislike.

In a nation of hunters competing for limited game, the hunt is a social contest, filled with vanity.

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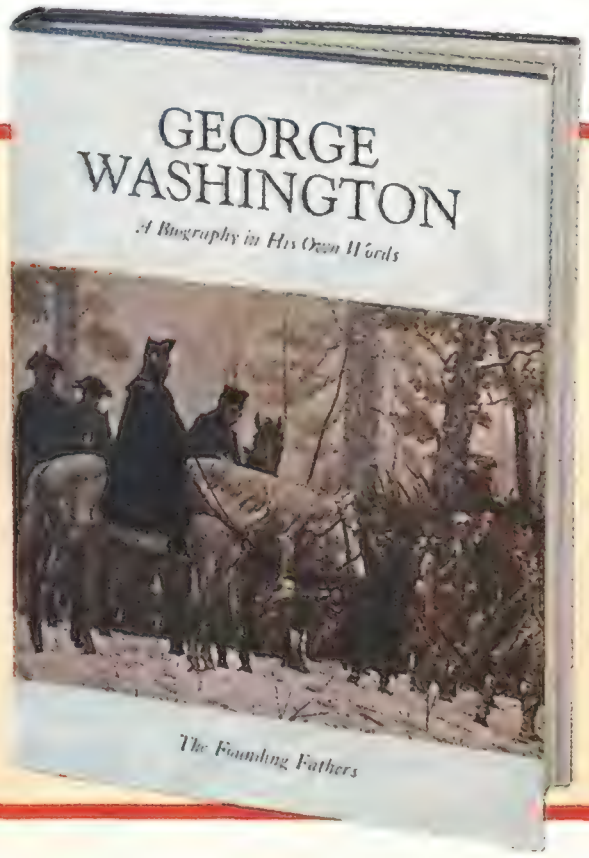

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One of Gordon's gunboats, heavily protected, battles its way toward besieged Khartoum.

Text and photographs by Don Carl Steffen

Khartoum tested British Empire

Here El Mahdi, messiah of Islam, inspired a bloodbath that made a martyr out of 'Chinese' Gordon and a hero of General Kitchener

General Charles Gordon stood at the head of the palace stairs, left hand on his sheathed sword, a revolver in his right. He used neither as the white-clad Dervishes rushed him, shouting, "Cursed one, your time has come!"

A spear plunged into his body. He gestured scornfully and turned his back, and another spear struck him, pitching him forward. Swords hacked at him. His head was cut off.

Thus, in January 1885, in the Sudanese capital of Khartoum, ended a strangely noncommittal attempt by Great Britain to save the Sudan from a self-proclaimed messiah who roused fanatical devotion in his thousands of warriors. The Sudan was then occupied by Egyptians, and Egypt was a recent acquisition of the spreading British Empire, and that is why "Chinese" Gordon was on the palace stairs at Khartoum.

Gordon got his nickname for having commanded a ragtag private army in China so successfully that he was made a mandarin. He was a brisk, bouncy general with slightly bulging blue eyes. He detested the social life of England, despised women—except for his older

Today, the gunboat *Bordein,* Gordon's
favorite, still lies at the banks of the Nile.

sister—devoted himself to the salvation of street urchins, whom he called his "kings" and whom he took into his home to feed, clothe, instruct and set on the road to success. Despite these eccentricities, Gordon was never touched by any hint of homosexuality. Perhaps his idealism and religious fervor repressed what might have emerged in a more permissive age.

Equally fanatical was El Mahdi, self-proclaimed cleanser and renewer of Islam, whose followers finally killed Gordon. At his height, the Mahdi controlled a million square miles of Africa. In the words of Byron Farwell, one of the ablest historians of those great days of Victoria's empire, "he successfully defied the might of Great Britain, then the most powerful nation on earth . . . establishing the first and only African nation ever to win independence from a foreign power by virtue of its own force of arms, courage and abilities."

His successes against Egyptian troops, some British-led, brought him thousands of converts. His teachings were simply to hate the infidel, avoid the vices of envy, pride and neglect of daily prayers and cultivate various virtues: humility, austerity, reverence. Drunkenness was punished by whipping through a public market; fornication drew 80 lashes, smoking 100; adultery was expiated by beheading the man and stoning the woman; thieves lost a hand and a foot; blasphemers and murderers were summarily executed.

The Mahdi's warriors—the British called them Dervishes—were convinced that those killed fighting for the messiah would be wafted to heaven by a host of angels, straight to Allah's side. Fearlessly, they would swarm over Sudanese forts in the face of Egyptian troops armed with American Remingtons. Finally a 10,000-man Egyptian army equipped with modern weapons and led by a British general, William Hicks, took the field. The Mahdi annihilated the entire force, capturing rifles, Krupp howitzers, brass mountain guns and Nordenfeldt machine guns, multibarrelled weapons that were fired by turning a crank —1,000 rounds a minute, if your arm held out.

Don Carl Steffen, free-lance writer and photographer, provided text and pictures for a previous book,
The Splendour of Africa, *which appeared in 1965.*

Britain was outraged. Gordon was dispatched to Khartoum, perhaps to report on the proportions of the Mahdist revolt, perhaps to evacuate the Egyptian troops from this outpost, perhaps to set up an independent government there which would retain ties with Egypt—and, perforce, Britain.

On February 18, 1884, Gordon arrived in Khartoum. He opened the prisons, publicly burned the tax records of the ruling Egyptian authorities and destroyed the hippo-skin whips they had used. "I will not fight with any weapons but justice," he stated. But Gordon badly underestimated the Mahdist revolt. It went far beyond complaints against tax collectors and whips. It was a holy war. Tribesmen who had opposed the Mahdi and looked for Egyptian troops to come and protect them were left high and dry by Gordon's peace-keeping actions. They joined the Mahdi.

Within four weeks of Gordon's arrival, the Nile tribes had risen for the Mahdi. The telegraph linking Khartoum to the north was cut and towns to the north captured, effectively blocking Gordon's retreat.

Gordon fortified his position with a small parapet, cannon, a ditch, barbed wire and mines. But by the end of March, 30,000 Dervishes surrounded Khartoum on three sides and fired into the town daily.

Gordon armored his flotilla of ten steamers and six barges and with them kept open communications down the Nile to Berber as best he could. He requested relief, but Gladstone's cabinet considered him simply a political emissary, not the commander of a besieged fort, and refused him.

The Mahdi moved with 100,000 men and a wealth of captured guns. These latter, at close range, made Gordon's steamers vulnerable, but he used his best, *Bordein,* fitted out as a gunboat, for protection. It came back with a shell hole just above the waterline. *Bordein* still ran the gauntlet downstream to Metemma, looking for the relief force and taking out messages and pages of Gordon's journal. One of the last installments, sent out in December, noted, "If the expeditionary force, and I ask for no more than 200 men, does not come in ten days, *the town may fall.*" He also wrote, "All that is necessary is for 50 of the expeditionary force to get on board a steamer and come up to Halfaya and thus let their presence be felt; that is not asking much, but it must happen *at once,* or it will as usual be too late."

A relief column had started in October, after Gladstone finally agreed to dispatch it. It was a large force under Britain's top army commander, General Sir Garnet Wolseley, who had the idea of building 500 whaleboats with which to negotiate the Nile from Cairo to Khartoum—1,000 miles as the crow flies. All this took time. Once underway, the expedition was delayed by the Nile's six cataracts which forced the boats to be dragged and hauled and sometimes unloaded by the troops. An overland contingent was formed and mounted on camels to dash across the desert toward Khartoum where the Nile makes a long detour.

On December 30 Wolseley was delivered a message on paper the size of a postage stamp: "Khartoum all right. 12.12.84 C.G. Gordon." Verbally, the messenger urged the general to bring many troops and not leave any threatening tribesmen in his rear. He reported that there were 18,000 Egyptian troops in Khartoum—actually, there were less than half that, and Gordon was not the man to urge caution. The message was probably a fake, but it persuaded Wolseley to abandon any dash for Khartoum.

El Mahdi was the religious firebrand of the Sudan. Gordon, a Christian, was equally devout.

In that dusty town supplies were exhausted, the Egyptian troops decimated. Men ate horses and donkeys until they were gone, then animal hides, rats, and pith from date palms. Dysentery raged, and many men were too weak to man the defenses—which themselves had been flooded and breached by the White Nile which here meets the Blue Nile.

Gordon's steamers met the advance party of the relief force on January 21, 100 miles downriver. And here, unaccountably, the commander of that party delayed three days to reconnoiter. They left for Khartoum on January 24. The steamer *Bordein* ran aground at the sixth cataract and had to be unloaded. They made only three miles in 24 hours. The next day voices from shore called out that Khartoum had fallen and Gordon was dead. No one believed it.

Gordon's head displayed

It was just after midnight on the morning of January 26 that the Mahdi crossed the Nile to inspire his warriors. Then, with artillery support, they struck at the gap in the defenses and broke through. Some troops formed squares, but couldn't hold them. A few escaped by running into the desert or swimming the Nile. It took about six hours to complete the killing.

Gordon died just before sunrise. His body was dragged into the garden of the palace, and passing warriors stuck spears into it. The head was carried across the river to Omdurman and displayed before one of the Mahdi's European prisoners, who later reported: "The eyes were half open, the mouth was natural, the hair and short whiskers were almost white except where stained with blood." It was "fixed between the branches of a tree and all who passed by threw stones at it."

On January 28, two steamers reached the vicinity of Khartoum and met heavy fire. There was no Egyptian flag flying. Aware that they were too late, the ships turned back. Both were wrecked and abandoned on the way downstream. The entire relief force left the Sudan, and the Mahdi deserted Khartoum for Omdurman where he forsook the ascetic life he preached and, perfumed and pampered by concubines, indulged himself into an early death—only five months after Gordon's. His mantle passed to his lieutenant, Khalifa Abdullah, who built the Mahdi a tomb with an 80-foot dome in the center of Omdurman. Next door stood the Khalifa's house with a second story—the only one in the country—reserved for his abundant harem.

Britain seethed at the disgrace and mourned Gordon. With the exception of one blunt fellow officer who maintained that "the man was not worth the camels," Gordon was practically canonized. He was smothered in Victorian clichés about outposts of em-

Sneering over its cud, a camel indicates its usual contempt for humans. British troops used the animals.

This version of Gordon's death has him stabbed. He wore fez to indicate Egyptian command.

Sudan's first automobile, a wooden-bodied Arrol, was brought to Omdurman by Sir Reginald Wingate after he took over as governor-general in 1899. It remains today—a reminder of those imperial days.

pire and the thin red lines. A popular song swept through the music halls:

Too late! Too late to save him.
In vain, in vain they tried.
His life was England's glory,
His death was England's pride.

A Conservative government swept in to power, bristling with imperialism, and hatched a new campaign against the Sudan to avenge Gordon. In 1896 an army under General Herbert Kitchener inched south into the heart of the Sudan, building stretches of railway and chunking up the river in 13 armored steamers. The Khalifa opposed this might with 17 mud forts armed with captured guns. He took comfort from a vision of many dead infidels.

Of course the outcome of the confrontation was never in doubt. The massed Dervishes flung themselves against the Anglo-Egyptians and were cut to pieces by modern weapons. Almost half of Kitchener's 48 dead occurred in the 21st Lancers who foolishly charged a hidden force of Dervishes and barely got out of the trap. In the lead was a young subaltern,Winston Churchill. Total losses for the Khalifa amounted to 10,800 dead and 16,000 wounded. No one knew how many had crawled to the Nile to die.

Today, 75 years after the Battle of Omdurman, many relics of those days of the British Empire's high tide remain. The palace where Gordon was slain has been rebuilt and bears a plaque to mark the spot at the head of the old stairs where he fell. Hundreds of weapons decorate the walls, including Roman swords handed down for centuries and used in the siege of Khartoum and the Battle of Omdurman which avenged it.

Moored in the Nile nearby is Kitchener's steamer, *Malek*, now headquarters for the Blue Nile Sailing Club. Descendants of the Mahdi's warriors visit the vessel which helped destroy his tomb during the Battle of Omdurman. Across the river, her planks rotting, her engine removed, lies the rusting hulk of Gordon's famous *Bordein*. The Khalifa's two-story house is now another museum with guns and medals and uniforms, including chain-mail shirts captured during the Crusades and worn in battle by the Mahdists. And here is Sudan's first automobile, a wooden-bodied Arrol with steering wheel in the back seat, brought to the country by Sir Reginald Wingate, one of Kitchener's officers, who later succeeded him as governor-general of the Sudan and moved into Khartoum's rebuilt palace.

At the river's edge, boats are being built as they have been for centuries, each plank hand hewn to fit, then caulked. One ancient Sudanese, busy at caulking, has boyhood memories of the great battle that ended Mahdist rule. But when an infidel questions him, he has simply a fierce, piercing stare.

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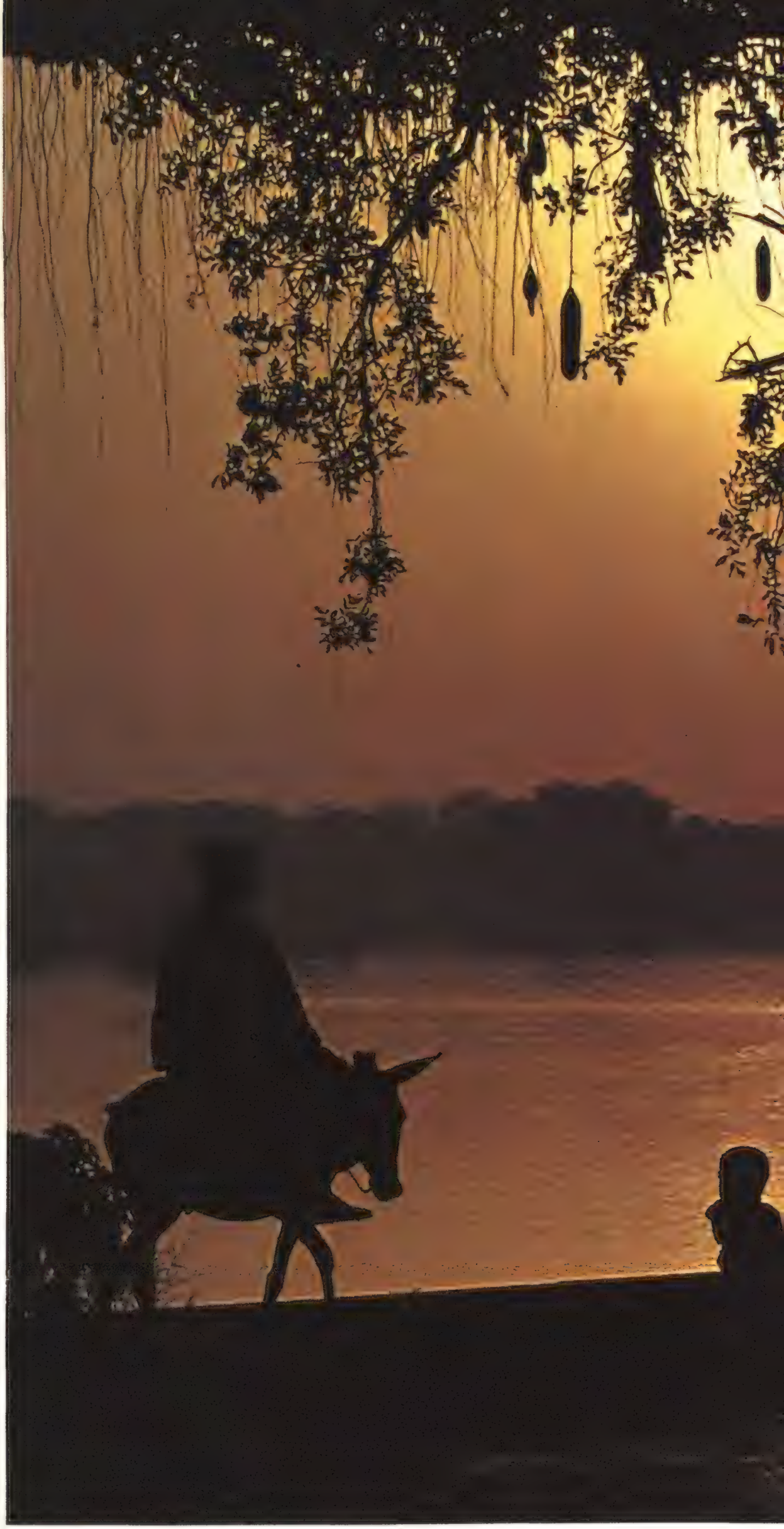

Low remains of Gordon's defensive wall abut the Nile at Khartoum. Here, rising water breached it.

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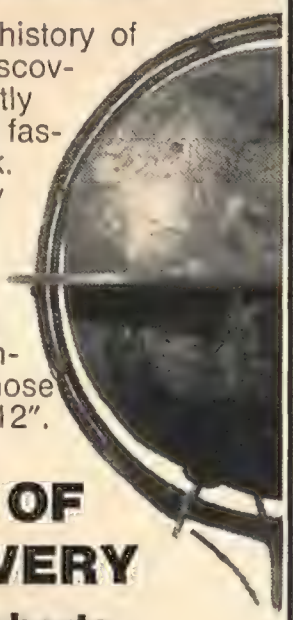

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Book reviews

The Brain Changers
Maya Pines
(Harcourt Brace Jovanovich, $7.95)

Brain researchers are piling up a mass of information. When that mass reaches the critical point, the explosion may be as capable as nuclear bombs of changing the nature of humans. Maya Pines' vivid report of the information already on hand leaves no doubt that a unifying theory, drawing together the findings of scattered experiments, must soon emerge.

The task of devising safeguards against deliberate or inadvertent misuse of brain manipulation can't be left to the experts, the author warns, since "neither physicians nor brain scientists are the keepers of our moral values." The outlines of the moral problem are already visible. Tranquilizers, for example, free great numbers of mental patients from institutional prison, but how many nursing-home patients are being stupefied with tranquilizers solely for the convenience of the staff? Lobotomy operations have solved some horrendous problems for society, but often at horrendous cost to the individual. Hyperkinetic children are being helped by powerful, mind-changing drugs, but how careful is the distinction between hyperkinetic children and those who are classroom nuisances simply because they are bright and energetic? The challenge of providing guidelines must be met by all of us, and Maya Pines gives us an intensely readable handbook to help us comprehend the issues.

The Brain Changers surveys research into the heavens and hells that exist inside our skulls in the "magical three and a half pounds of pinkish-gray jelly" where

ten billion nerve cells transform "ten watts of electricity and some chemicals into our thoughts, feelings, dreams, memories—our awareness of being ourselves." There lie fantastic capabilities for achievement, for pleasure and ecstasy, there lie the possibilities of relief from pain, of preventing untold misery—and the possibilities of turning the human race into robots. The book shows these possibilities in fascinating detail.

A book to bring this field into focus for the layman has been sorely needed. Headlines, such as these, have followed each other: "Challenge and variety make a rat's brain heavier, thicker"; "Theta waves sensationally improve the brain efficiency of humans"; "One three-millionth of an ounce of LSD can make you act insane"; "Drugs to improve memory"; " 'Speed' kills." Spilling over from the laboratory into the common language are terms like bio-feedback, operant conditioning and alpha highs. Maya Pines wraps up each of these and other less widely heralded developments and relates them to each other in a book that combines the fascination of a spy yarn with that of science fiction.

To tackle so broad a survey of such a complicated field and present it in non-technical language inevitably involves some measure of simplification. No matter; the author is scrupulous about telling us who is doing the work she reports, and where. Judging by the quotations she includes, the brain researchers themselves don't always know what to make of their discoveries. As Dr. Gardner Murphy of the Menninger Foundation put it, "While some of the claims being made . . . may turn out to be overbold, most of them will prove to have been not bold enough."
—Pat Tucker
Co-author with Dr. John Money of
a forthcoming book on gender identity

Ardent Spirits:
The Rise and Fall of Prohibition
John Kobler
(Putnam, $8.95)

Ardent spirits are, of course, distilled liquors; but John Kobler's title refers also to the ardent swarms of saints and hypocrites who battled against liquor in America. This is first-rate popular history, full of anecdotes and vivid personalities, with a compelling narrative.

Those who imagine prohibition mostly

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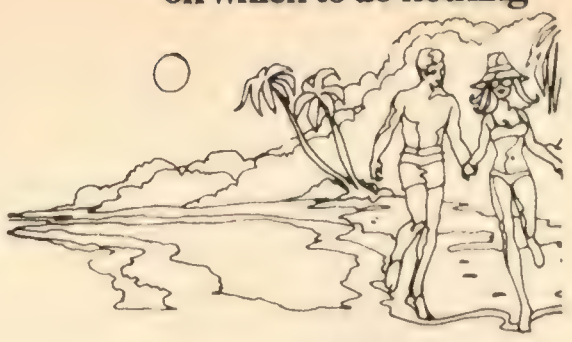

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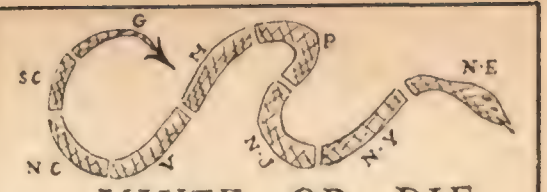

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as an episode from the roaring Twenties will be surprised at how far back in our history the controversy runs. The early settlers, and many of our Founding Fathers, "tended to preach abstemiousness more than they practiced it." Even the pious Cotton Mather was not above sanctioning piracy to obtain a cargo of rum. In a letter in 1682, Mather spells out an abortive scheme for waylaying a ship full of Quakers, including William Penn, and trading them as slaves in Barbados in return for a cargo of rum. Among medical men, Benjamin Rush, one of the most prestigious American physicians of the 18th century, campaigned against alcohol vehemently. Although Dr. Rush was opposed to drinking the stuff, he did believe that dumping half a pint or so into your boots would prevent a chill in wet weather.

The crusade against liquor was taken up by many abolitionists before the Civil War. Abraham Lincoln, who at one time sold liquor himself, was forced into some awkwardly equivocal speeches on temperance. Later in the 19th century temperance became a code word for xenophobia; it was hoped that Irish and German immigrants, if prevented from drinking, would somehow vanish. Later still, thanks to the Women's Christian Temperance Union, the cause somehow became entwined with the battle for women's rights.

The prohibition amendment finally passed, Mr. Kobler suggests, because the lobbyists for it were well-organized, while their opponents were not. The law was universally subverted as soon as it was passed. This part of the story, with bootleggers and bathtub gin, is legendary now. Somewhere in the author's rogues' gallery of the period you are bound to find your favorite character. Remember Izzy and Moe, the famous pair of prohibition agents? Izzy Einstein, self-styled master of deceit, disguised himself as everything from a grease monkey to a cattle rancher while trapping bootleggers. Unlike most agents, the elusive Izzy was both successful and incorruptible, and so was fired "for the good of the service."

Today prohibition fervor is at low ebb. The search goes on, however, for a single villain responsible for all the evils of mankind. Recently, Mr. Kobler notes, marijuana was auditioned for the role.

—Madeleine Lundberg

Author of SMITHSONIAN articles on LSD (January 1971), hypnosis (March 1972)

A Different Woman
Jane Howard
(Dutton, $7.95)

Jane Howard is a graduate of *Life* magazine who has been traveling on her own for considerable distances. Her first time out she gave us *Please Touch,* a personal report on the frantic proliferation of encounter groups, gathered over a whirlwind year and held together by her own solid rationalism and a clear writing style.

In *A Different Woman* she is on the road once more: a peripatetic seeker of truth who flies by jet and alights now and again on familiar turf to warm herself briefly. This time her subject is the state of the nation's women, in flux since the birth of the liberation movement.

What began as a journalist's objective inquiry was smashed to smithereens at the start of her travels by the sudden death of her mother. Abandon the project or continue? Jane Howard continued. Her mother's death and a continuing, close relationship with her younger sister—a sister who moved in more conventional Midwestern patterns, getting married, having children—pressed upon her as she flew from city to city interviewing movement women, seeking the "typical" housewife and seeing old friends.

And so, perhaps despite herself, Jane Howard began writing an autobiography as much as a report on the effect of feminism in the American heartland. The disconnected threads of her existence got woven into the fabric: mother, father, sister, Midwestern roots and Jewish friends in New York, psychoanalysis, Greenwich Village apartments and the men she didn't marry. To sum it up for us, she calls her finished product a patchwork quilt; and it is indeed that—bits and pieces of old and new, fashioned in a patchwork of highly stylized, intricate design. A gestalt of many lives in flux, but most authentically her own.

In the 19th century, such authors as Fanny Kemble, Harriet Martineau and Frederick Law Olmsted (SMITHSONIAN, December 1972) were restless travelers who roamed continents and distilled their observations for the benefit of less adventurous stay-at-homes. Regarded in their day as interesting, iconoclastic observers of current events, they produced journals that proved invaluable as documents of history. I doubt if Jane Howard thought about this when she embarked upon her

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journey and, if she had, it might have frozen her fingers when she sat down at her typewriter. But the purposeful traveler is a grand old tradition, and it is invigorating to see it so deftly revived.
—Susan Brownmiller
New York writer and critic

The Secret Life of Plants
Peter Tompkins and Christopher Bird
(Harper & Row, $8.95)

Are there interrelationships between men and plants? According to *The Secret Life of Plants,* plants and men do interrelate, with plants exhibiting empathetic and spiritual relationships and showing reactions interpreted as demonstrating physical-force connections with men. As my students say, "Hey, wow!"

For a review of this book, I could adopt the Jovian-scientist approach, stating that the reports are meager and inadequate—which they are. I could choose the fussy-scientist line, noting the many errors of botanical fact which serve to undermine the credibility of the authors. Alternatively, I could become the legalistic scientist, pointing out that many of the quotations supporting various claims can have entirely different interpretations from those ascribed to them, and also noting that statements about now-dead people are hearsay and not admissible as proof.

The thunderer, the nit-picker and the legalistic methods are, however, out of place. Frankly, we professional scientists must adopt an agnostic stance. If I can't "get inside a plant" or "feel emanations" from a plant and don't know anyone who can, that doesn't detract one whit from the possibility that some people can and do. Although there is a considerable element of self-serving among some "psychobotanists," with a few of them becoming leaders of psychic institutes, I, too, earn my living as a botanist and can't throw stones at my own greenhouse.
—Richard M. Klein
Botany professor, University of Vermont

Peking to Paris
Luigi Barzini
(Library Press, $8.95)

The wonder of this 1907 motorized odyssey across Eurasia is not that the 40-horsepower Itala won the automobile race, or even that it finished, but more that its three-man Italian crew didn't suffer utter

The Prince and Barzini before the race; below, their car tangles with a bridge.

catastrophe along the way. Such a trip today—were it diplomatically sanctioned—would take the utmost of man's skill, forbearance and luck. In 1907, with the automobile in its infancy, two-thirds of the overland route rougher than a cowpath, and highwaymen lurking everywhere, Prince Scipione Borghese, journalist Barzini and the driver, Ettore Guizzardi, sailed through as if in a fairy tale.

Indeed Barzini's narrative assumes an airy, comic, melodramatic quality not unlike that of Jules Verne's *Around the World in Eighty Days.* It is no coincidence that the original Italian title of *Peking to Paris* included the words "Halfway around the world in 60 days." In Italy, the book, published directly after the race, was received as anything but a fairy tale. Adults took it to their hearts as proof to the world that Italy could produce automotive genius, not just artistic relics. For a few decades schoolboys won the book as a prize for passing grades.

Now, more than 40 years since its last Italian printing, *Peking to Paris* has reemerged in English with an introduction by the author's son, Luigi Barzini jr., who wrote *The Italians* and *From Caesar to*

the Mafia. Added, too, are more than 60 photographs that the senior Barzini—an accomplished and much-traveled foreign correspondent—snapped along the 8,000-mile journey.

In the end our heroes face much sterner competition from the elements than from the rival autos of France and Holland. Barzini scarcely mentions the Itala's foes in the last third of the book. Rain, mud, wind, dust and finally ennui are the true enemies. It takes the dogged trio 46 days and 5,000 miles merely to reach a flat, straight road just east of Moscow.

"Now, now only, did we feel as if we had triumphed over every difficulty," Barzini writes. "We should now no longer have to climb rocks, descend into abysses, bound over trunks of trees. We would no longer now sink into insidious swamps. . . . The road would lead us. . . . It would comfort us."

When the Itala finally leaves Russia behind, Barzini is able to look back with affection at the "serene, majestic, gospel-like image of a mujik [peasant] arising before us with his fair beard, his long hair—always helping us out of some difficulty, saving us from the mud, or from the swift current of a river, or sometimes from hunger."

By then, of course, he can forget the stone-throwing mob that chased the Itala from a Russian village and the stubborn Russian telegraph clerk who, taking Barzini and his companions for Orientals, transmitted the writer's daily news dispatch vertically as though in Japanese. By then, too, it is all downhill to Paris, and a hero's welcome—the same sort of welcome that the city would extend 20 years later to a voyager named Lindbergh arriving from the other direction.

—David Butwin

Free-lance writer, foreign traveler, automotive innocent

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Travel the Smithsonian way

One of the benefits of being a Smithsonian Associate is the opportunity to participate in Foreign and Domestic Study Tours, led by Smithsonian Institution curators or other experts. These specialized, quality tours offer a combination of study, vacation, discovery and adventure to Associates and their families.

FOREIGN STUDY TOURS

Sites of Civilization Cruise: From Rome to Athens, via Sicily, Malta, Tunisia, Egypt, Thera and Cyprus on the spacious yacht *Argonaut,* chartered especially for Smithsonian Associates—April 6-27.

Greece: Sites and flowers in northern Greece and the Peloponnesus—April 27-May 11.

Victorian Germany: Castles and palaces associated with Queen Victoria, including Prince Albert's birthplace at Rosenau—May 6-26.

Ethiopia and Kenya: Ancient and contemporary cultures from Aksum to Lalibela, plus several days in Kenya—May 24-June 14.

Black Sea Cruise: Depart and return Athens, via Turkey, Bulgaria, Romania and Russia—September 17-October 6.

Afghanistan and Pakistan: Archaeological and historic sites—October 20-November 11.

DOMESTIC STUDY TOURS

Mound Builders of Georgia: How did the builders of the Etowah Mounds acquire grizzly teeth from the Rockies and marine products from Florida? Who were the "master farmers" who invaded the Ocmulgee Mound area about A.D. 900 and where did they come from? What prompted prehistoric Indians to carry thousands of white quartz rocks over great distances to build the 120-foot-wide Rock Eagle Effigy Mound? Pursue these and other mysteries raised by the fascinating prehistoric mound cultures of the Southeast—February 18-24.

Old Sturbridge Village, Massachusetts: A nostalgic winter weekend of sleigh rides, singing, square dancing and delicious food—January 25-27.

Science Weekend at the Smithsonian: Join behind-the-scenes tours of scientific exhibits and research facilities and take a scientist-led field trip to the National Zoological Park or the Chesapeake Bay Center for Environmental Studies—March 22-24.

California Channel Islands: Enjoy seven days in a spectacular setting off California's coast studying the notable bird and plant life on these islands—April 15-22.

San Antonio, Texas: Celebrate Fiesta San Antonio while learning about the colorful history of Texas and its multi-cultural heritage—April 20-26.

Crafts of Arkansas: An intimate encounter with various historical crafts and the people preserving them—May 12-18 or May 19-25.

Santa Fe and Taos, New Mexico: Enjoy an evening at the spectacular outdoor Santa Fe Opera; visit galleries of Southwestern art and anthropology—June 25-31.

Boston Art and Architecture: Private tours of country mansions, colonial gardens, Bulfinch houses and Beacon Street—June 21-24.

For information on specific tours, write Miss Bliss Schumann, Foreign Tours, Room SI 123 or Mrs. Diana Parker, Domestic Tours, Room SI 106, both at Smithsonian Institution, Washington, D.C. 20560.

Smithsonian highlights

Freer Gallery of Art
"Ceramics from the World of Islam" is the third show commemorating the 50th anniversary of the Freer Gallery. More than 100 objects from Iran, Iraq, Syria, Egypt, Turkey and Spain are featured in this first major exhibition of Islamic pottery in the United States. The ceramics, ranging from the 9th to the 19th centuries, reflect the popular taste of the Muslims, as well as the influence of foreign invasions and dynastic changes throughout the ten centuries—opens January 16.

Division of Performing Arts
"The Western Wind" is a program of early American vocal music performed by a choral group of six singers—January 7, 8:30 P.M., Hall of Musical Instruments, Museum of History and Technology.

"The Jazz Heritage Series" presents the Charles Mingus Quintet in concert—January 20, 4:30 P.M. workshop, Hall of Musical Instruments, Museum of History and Technology; 8 P.M. concert, Baird Auditorium, Museum of Natural History.

The Paul Hill Chorale performs songs based entirely on transportation, presenting tunes of the sea, rails, city and country—January 22, 8:30 P.M., Train Hall, Museum of History and Technology.

The "String Bands, Old and New" series presents the Henry Miles Jug Band and the Balfa Brothers in a double-bill program—January 27, 8 P.M., Baird Auditorium, Museum of Natural History.

For ticket information on the above events, call (202) 381-5395.

Renwick Gallery
"Paintings from Pakistan" is an exhibition of 25 contemporary paintings by various Pakistani artists—opens January 17.

"Shaker: Furniture and Objects, Renderings of Textiles and Costumes, Inspirational Drawings" is a continuing major exhibit celebrating the forthcoming 200th anniversary of the arrival of the Shakers in this country.

Museum of History and Technology
"Two Hundred Years of Needlework" is a Smithsonian tour highlighting various types of embroidery displayed in the museum exhibit halls. Included are quilts, clothing, samplers and embroidered pictures. The tour is open to the public and begins every Tuesday morning at 10:15 beneath the "Star Spangled Banner." Arrangements for large groups can be made by calling (202) 481-5030 before 1 P.M.

National Collection of Fine Arts
"Joseph Cornell Boxes," a continuing exhibition organized by Walter Hopps, visiting curator of contemporary art, presents a collection of Cornell's enchanting, poetic shadow-box constructions.

"Marguerite Zorach: The Early Years, 1908-1920" is a continuing exhibition of 40 prints, drawings and recently discovered paintings, which have led to a re-evaluation of the artist's work.

"Steinberg at the Smithsonian" (see p. 54) presents 36 drawings created while Saul Steinberg was artist-in-residence at the Smithsonian.

Puppet Theater
"Pinocchio" begins January 16 in the Arts and Industries Building. Performances are on Wednesdays, Thursdays and Fridays at 10:30 and 11:30 A.M., and on Saturdays and Sundays at 11 A.M., 12:30 and 2:30 P.M. Children under three excluded. For ticket information, call (202) 381-5395.

Smithsonian Commons
Luncheon facilities for Smithsonian Associates are in the original Smithsonian Building. Open Monday through Friday from 11:30 A.M. to 2 P.M., the Commons offers a buffet luncheon from $1.50 to $1.95. Also available are coffee and pastries from 10 to 11 A.M., and tea and pastries from 2:30 to 4:30 P.M.

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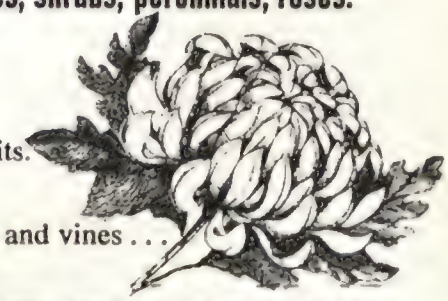

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Museum of Natural History

"The Ascent of Man," a film series depicting the history of man through the history of science, continues through January. Filmed in 27 countries and coproduced by Time-Life Films and the British Broadcasting Corporation, the series presents the views of Dr. Jacob Bronowski, senior fellow at the Salk Institute. Each film explores the discoveries that have shaped Man's evolutionary, cultural and intellectual history—8 P.M. Wednesdays, Baird Auditorium. No charge. For daytime program information, call (202) 381-6484.

Associates' Events

"New York Midtown Art Tour" provides an insider's view of the heart of the New York art world. Beginning with a private luncheon at the Museum of Modern Art, the tour includes visits to galleries, museums, private collections and an invitation to the opening of the Whitney Museum of American Art's new show (see next issue of SMITHSONIAN), "The Flowering of American Folk Art—1776-1876"—January 31-February 1. For information on this and other Associates' events, call (202) 381-5157.

Traveling Exhibition Service

There are up to 70 different Smithsonian-sponsored exhibitions on display each month throughout the United States and Canada. For a complete listing and information on how to bring an exhibition to your area, write: Traveling Exhibition Service, Smithsonian Institution, Washington, D.C. 20560.

- Peoria, Illinois—"The American Artist and Water Reclamation" (Caterpillar Tractor Company, Jan. 5-Feb. 3).
- New Orleans, Louisiana—"Kurt Kranz: Bauhaus and Today" (New Orleans Museum of Art, Jan. 19-Feb. 17).
- Waco, Texas—"Permutations: Earth, Sea, Sky" (Waco Creative Arts Center, Jan. 12-Feb. 10).
- Chattanooga, Tennessee—"The Monotype: An Edition of One" (Hunter Gallery of Art, Jan. 5-Feb. 24).
- Pensacola, Florida—"Handicrafts of the Southeast" (Historic Pensacola Preservation Board, Jan. 12-Feb. 24).
- Decatur, Illinois—"Guajiro Tapestries from the Mali Mai Workshop, Venezuela" (Millikin University, Jan. 5-Feb. 3).
- Allentown, Pennsylvania—"The Five Sense Store" (Allentown Art Museum, Jan. 19-March 3).

Contributing Memberships

Persons who contribute $50 or more annually to the Associates support the Institution's national educational programs and enjoy additional privileges. Graduated benefits include:

- Assistance in communicating with any part of the Smithsonian.
- Information on any museum in the world in advance of a visit there.
- Smithsonian annual report and other publications.
- Invitations (when in Washington) to exhibition previews and special events, including admission of a guest.
- Research service for questions about subjects related to the Smithsonian.
- A remembrance from the Smithsonian in the form of a commemorative object or work of art. Write: Contributing Membership, Smithsonian Associates, Smithsonian Institution, SI 118, Washington, D.C. 20560.

Parking on the Mall

Metro construction has made parking on the Mall near the Smithsonian complex extremely difficult. All parking prior to 10 A.M. is restricted. The use of public transportation is recommended.

Smithsonian Institution Offers Aviation Relic

The famous Douglas World Cruiser #2, "Chicago," which made the first round-the-world flight in 1924, has been restored and will soon be put on display at the National Air and Space Museum. In restoring this fine old aircraft it was necessary to replace the torn and deteriorated original fabric which covered the wings, fuselage and tail sections. Rather than destroy this historic fabric, it is being offered to the public on a first come, first served basis.

DOUGLAS WORLD CRUISER #2
"CHICAGO"

A square of fabric approximately 2″ X 2″ has been cut from the best portions of the "Chicago's" discarded skin and mounted on a handsome 15″ X 20″ poster under a colored print of the "Chicago" and her sister ships, the "New Orleans," the "Seattle" and the "Boston."

The National Air and Space Museum makes this valuable piece of history available to the public in time for the 50th anniversary of the "Chicago's" history making flight.

This will be the first of a series, and will be issued in a limited quantity. Worthy of framing, a highlight of any aviation collection, the ideal gift for the aviation enthusiast, this historic poster is not to be missed.

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By Patrick Ryan

Business as usual down at the old necropolis

Thanks largely to Evelyn Waugh and Jessica Mitford, it has long been a literary fad to lampoon the commercial accent of American funeral rites. Now reports from across the Atlantic indicate that European morticians are coming up fast.

From Italy comes news of the opening of the first undertaker's supermarket in Milan where customers may pick up at discount everything from a coffin to a black-edged card. Competition among the city's 80 funeral firms is so cutthroat that doctors, nurses and parish priests receive payola from their retaining morticians for dropping first word of a visit from the Grim Reaper. As for the general public, the first to the telephone after a loved one breathes his last can choose from such prizes as a suit, dress, 100 pairs of stockings, two spring mattresses or—perhaps on the chance that a replacement spouse is in the wings—a baby carriage.

In France, the sepulchral industry is currently racked by conflict between the monopolistic Pompes Funèbres, Europe's largest layers-to-rest, and a network of small funeral parlors. Allegations have been made that in some towns political corruption has helped give the "PF" the lion's share of France's 550,000 burials a year. One firm has been caught tapping the PF telephone to find out their price for an interment, and then dashing round to the relicts with a cut-rate offer.

In Russia, complaints have been made about officials of the state funeral bureau exploiting the bereaved for a fast ruble. From Moscow it has been reported that bribery is essential if the dear departed is to get a coffin, a grave dug and headstone mounted before the Archangel Gabriel announces the end of the world and renders the whole process superfluous. Cemetery officials illegally and unfeelingly charge money for the grave site, digging of the grave and for giving it a finished appearance. The available hearses in the state funeral car pool operate on a tight time schedule, speeding to and from the cemeteries so rapidly that, according to a Soviet paper, "one cannot easily tell whether the dead man is going to his eternal rest or to put out a fire."

We humans have always been divided about the best way of disposing of ourselves after we have shuffled off this mortal coil. Egyptians practiced mummification; Romans generally preferred entombment; Vikings launched their late lamented in blazing boats. Hindus burn cast-off bodies on kindling pyres; Muslims bury their departed lying on their right sides facing Mecca; and Parsees expose their dead on "towers of silence" as provender for vultures. Solomon Islanders have lain those not lost but gone before on coral reefs as food for sharks; other Melanesians have eaten up their time-expired relatives themselves. The Irish hold wakes which threaten to dissolve both mourners and loved one in alcohol; and the Koryak tribe of northern Siberia make their last farewells by playing cards on the corpse.

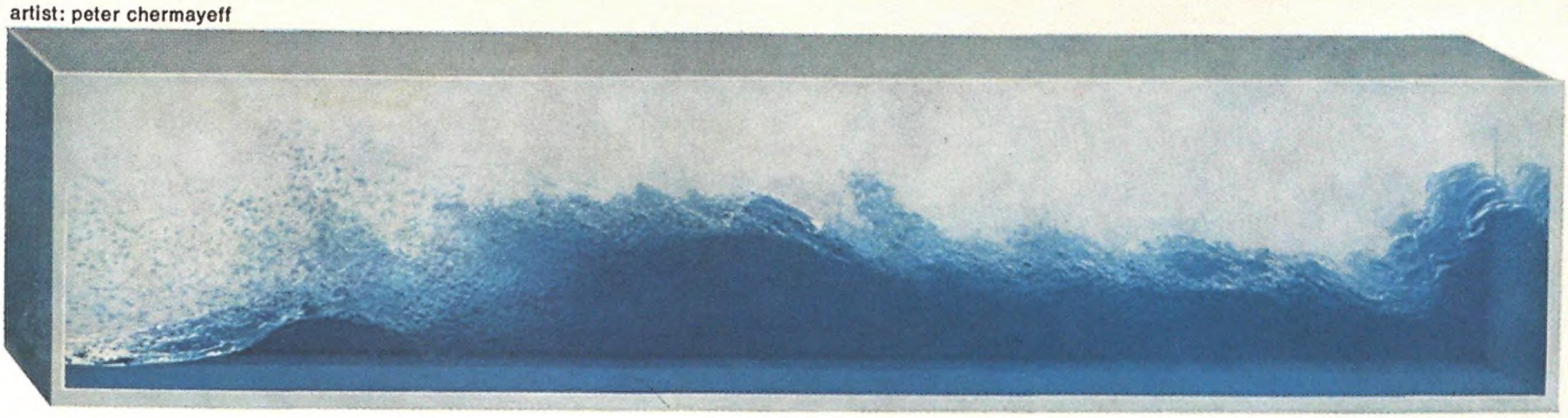
Now, a new dimension in disposal has been reported from Nashville, Tennessee, where the first part of a three-winged skyscraper mausoleum is under construction. The Cross Mausoleum, a 20-story building, will accommodate about 100,000 defunct customers and is forecast to release a whole lot of Tennessee acreage for jollier purposes. "The land for 100,000 cemetery lots would require 192 acres," calculated an official of the controlling Woodlawn Mortuary Incorporated. "With the mausoleum, including parking facilities, it will require 14 acres."

That's quite a point when you recall that Père-Lachaise cemetery in Paris covers more than 100 acres. In Britain, advertisements have recently appeared urging newspaper readers to opt now for final cremation and thus, "Be a land-saver. . . . Join the Cremation Society."

Apart from land-saving, the Woodlawn "High-Rise Necropolis" will make it possible for the remains of Nashville's wealthy to be borne heavenwards, as though by angels, in a flower-decked elevator. The higher up, the closer to paradise; the nearer the top of the tower, the nearer, my God, to Thee.

A crypt in this Hilton of Mortality will cost from $2,000-$3,500, which recalls the words of Bumble the beadle to Sowerberry the undertaker as Oliver Twist was being sold by the former to the latter: " 'You'll make your fortune, Mr. Sowerberry,' said the beadle, as he thrust his thumb and forefingers into the proffered snuff-box of the undertaker: which was an ingenious little model of a patent coffin. 'I say you'll make your fortune. . . .' "

artist: peter chermayeff



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